SCIENTIFIC AMERICAN

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By Prof. Henry Norris Russell

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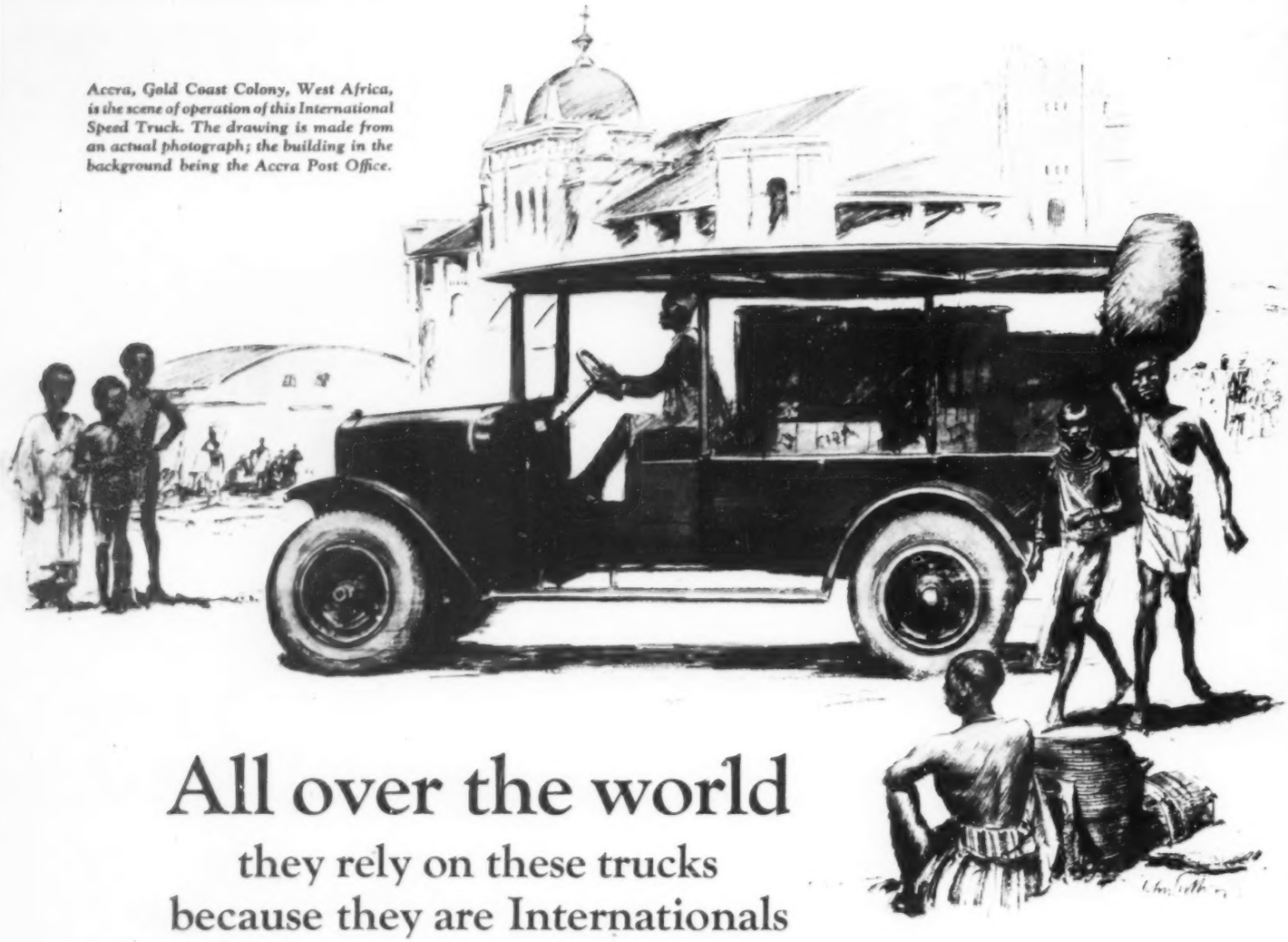

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SCIENTIFIC AMERICAN

THE MAGAZINE OF TODAY AND TOMORROW

NEW YORK, JUNE, 1927 | *Edited by* ORSON D. MUNN | EIGHTY-THIRD YEAR

STARS

DR. HARLOW SHAPLEY, Director of the Harvard University Observatory, recently told the students and graduates of Princeton University that he feared they did not themselves realize the high standing of Princeton in astronomy. "Apparently," he said, "they are not aware that in a recent impartial sorting of graduate schools for the higher teaching of astronomy, Princeton was, by common astronomical agreement, placed above Yale and Harvard, above Dartmouth, Columbia, Cornell, Pennsylvania and dozens of other universities and colleges where the subject is taught."

The department of astronomy at Princeton is headed by Prof. Henry Norris Russell, who has also been astronomical editor of the Scientific American for 27 years. "Directly or indirectly," continued Dr. Shapley, himself perhaps one of America's three foremost astronomers, "Dr. Russell referees more astronomical problems than anyone else in astronomy."

Who is the third of the foremost astronomers? We nominate Dr. George Ellery Hale, Honorary Director of the Mt. Wilson Observatory, California.

IMMIGRANTS

LET us understand this question of restricting immigration. In the first place, we do not stand in need of a larger volume of raw, unskilled labor. Where would we use it? Digging ditches? A large mechanical ditch-digger can do the work of 400 picks and shovels. On the farms? In the factories? Tractors, cranes and a host of labor-saving devices of all kinds and descriptions make an army of illiterate hands unnecessary.

There may be many reasons for opening the door to the peoples of the Old World—an asylum from oppression, an opportunity for education or economic advancement, reunion with relatives—but whatever the reason may be, it is not the need for illiterate, unskilled day laborers. We needed them once, but not now. Applied science has solved that problem in a manner perfectly satisfactory.

TELEVISION

SINCE page 385 of this issue, on which is described a new television system, went to press, a new angle of the problem has been revealed. It has been demonstrated practically that both the voice and the "picture" currents can be sent over the same wire, or in the case of radio transmission, over the same wavelength. An important phase of the latter is that much-needed space in the ether will thus be conserved, and interference greatly reduced.

Announcement

NEXT month we are giving you an improved Scientific American—handier in size, more attractive, more up-to-date.

When I became editor a little more than a year ago, it was with the resolve that I would give the best that was in me to produce a magazine worthy of its fine traditions, a publication which would justify your faith and the faith of America's leaders of thought in this eighty-year-old publication. In other words, I set out with conscientious earnestness to make the Scientific American all that you and I think it ought to be.

Some of the things are now matters of history. More pictures have been added; articles have appeared over the signatures of some of the world's greatest scientists; the editorial staff has been increased, this last step making it advisable for us to move from our somewhat cramped quarters in the Woolworth Building to our own building.

I am sure you will agree with me that if there is one thing the Scientific American stands for, it is progress. Now, progress as I see it, demands that the Scientific American not only report the world's latest and greatest achievements to you, but that it show progress in its own physical form. Therefore we must embody in the Scientific American's own make-up, the last word in magazine development.

And so I have come to the changes which we are making and which we trust will please you. In the new size the magazine will be much handier to carry and to hold. It will look more attractive. It can be read more easily. The new format will permit of a more elastic make-up; that is, pictures and text may be arranged in greater variety. Economies in time, effected by a new method of printing, which has been made necessary by a large increase in our circulation since the first of the year, will enable us to close our editorial forms later than heretofore, thereby allowing us to report later news of scientific achievements of importance. Economies in cost of manufacture will permit greater expenditures in obtaining articles of especial interest to you. The improved Scientific American will have a page measurement of nine inches by twelve inches, and will contain 96 pages.

Now these improvements are not all. We intend to keep right on making the Scientific American better and better with each issue. Of course, that cannot be done without experiment. The only way to find out whether a new idea is really sound is to give it actual trial, and then to listen to the reaction and comments from you for whom we make the magazine. Do not forget that we always want your comments and advice on any changes that we may make.

In closing, let me say that I like to think of the Scientific American as a sort of lighthouse of progress, which it is my privilege to keep lighted for you. It will remain standing in the same place and it will serve the same purpose as before. What I am doing now is to polish up the reflector. See if you do not find it shining more brightly.

O. D. M.

LOPSIDED

DR. E. E. SLOSSON, Director of *Science Service*, has been doing some figuring. He has worked out for each country what he calls the "national index of scientific research." He has taken the list of Nobel prize awards and found out that out of the 72 physics, chemistry, physiology and medicine prizes awarded since 1900, the Germans won 21; the British 11; the French 10; the Dutch 6; Americans 4; the Swedes 4; the Danes 3 and the Swiss 3; Austria, Italy, Canada and Russia two each, and Belgium and Spain one apiece.

This looks as if the Germans won, while we got nowhere. But the Germans *did not* win, although we got little better than nowhere! It is the Dutch, the Swiss and the Danes who go to the head of the class when you figure it out on a basis of percentage of population. We are not quite at the foot of the class but nevertheless there is not much satisfaction in our position: Russia stands at the foot and we are next.

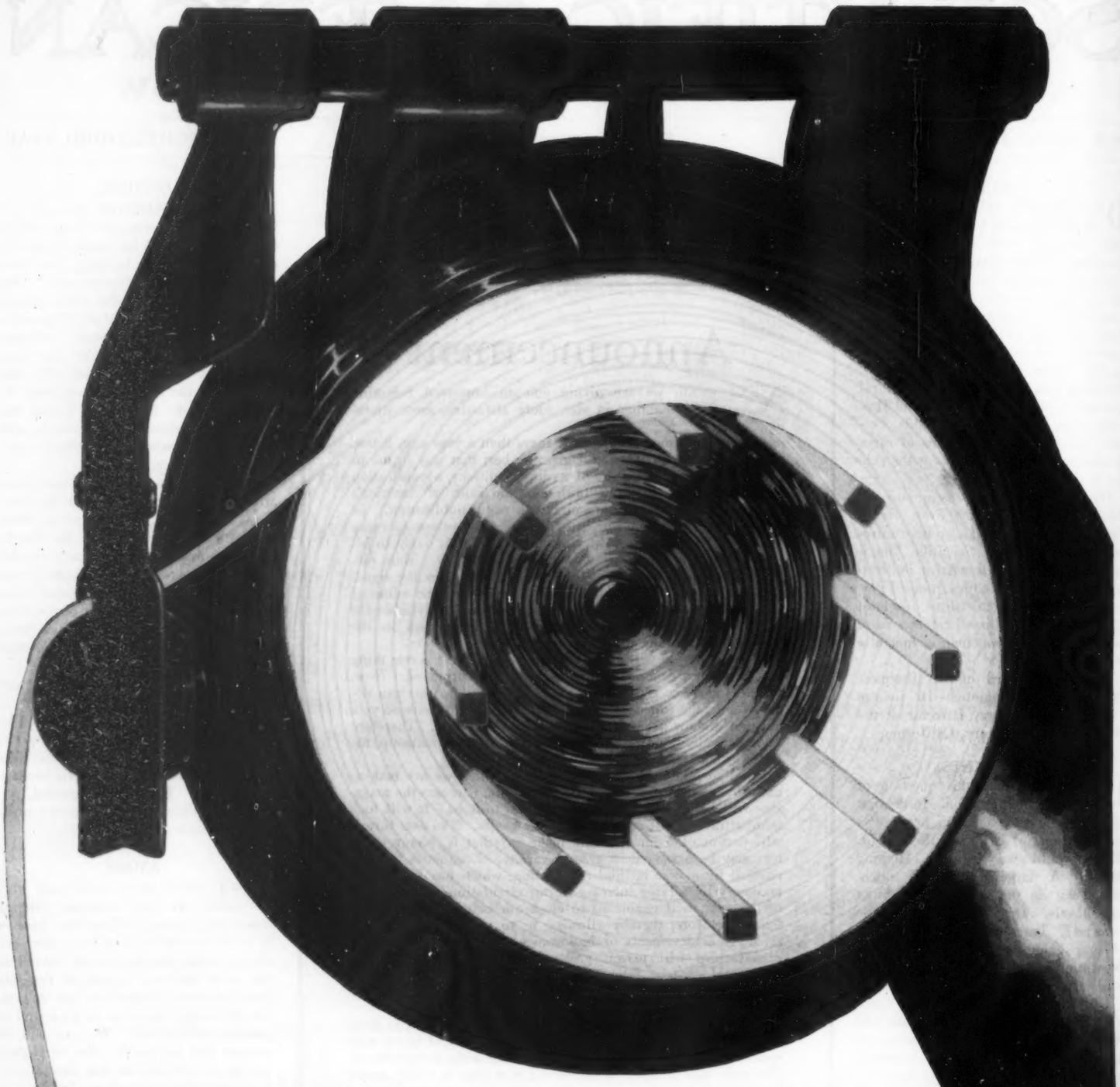
The prizes are awarded for pure science. In applied science the story is quite different—we go up. We are like the lad that gets a school grade of 99 percent in geography because he likes it, and 40 percent in arithmetic because he does not. That boy is lopsided.

Isn't it time, then, for us to study our arithmetic a little more?

SNOBS

ONCE in a great while—not very often—we hear someone running down the Scientific American because it is "so superficial." By this they evidently mean that we do not enter into the more abstruse aspects of the subjects treated. Purposely we do not. The Scientific American is a journal of popularized science. We can and do assume that our readers are intelligent, but we do not assume that they are exhaustively trained in all the branches of science, industry and engineering. Nobody is. The few who feel themselves above us would like us to dig deep—at least into *their* specialty. (How they would fare with the other fellow's specialty is another question which probably contains revealing as well as amusing possibilities!)

For ourselves, when we get on new ground we like to have things explained simply. Carlyle's "History of the French Revolution" is inspiring, but we *learned* more from a child's story of the same events—it was more comfortable reading. In editing the Scientific American we try to be honest with ourselves, knowing there are more people of that kind in the world than intellectual snobs.



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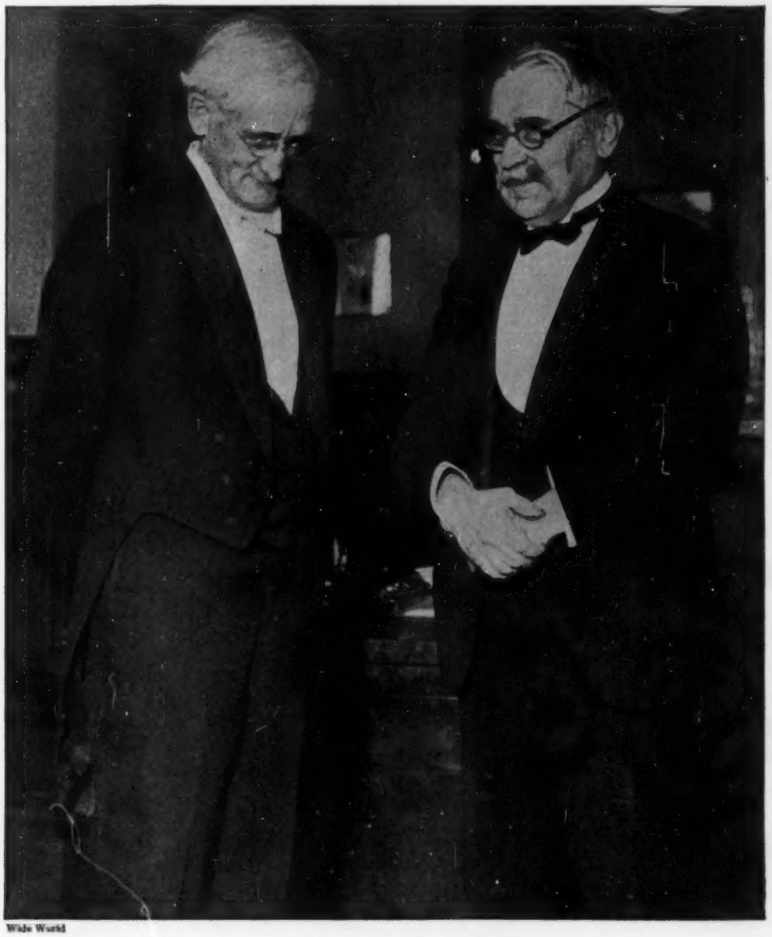
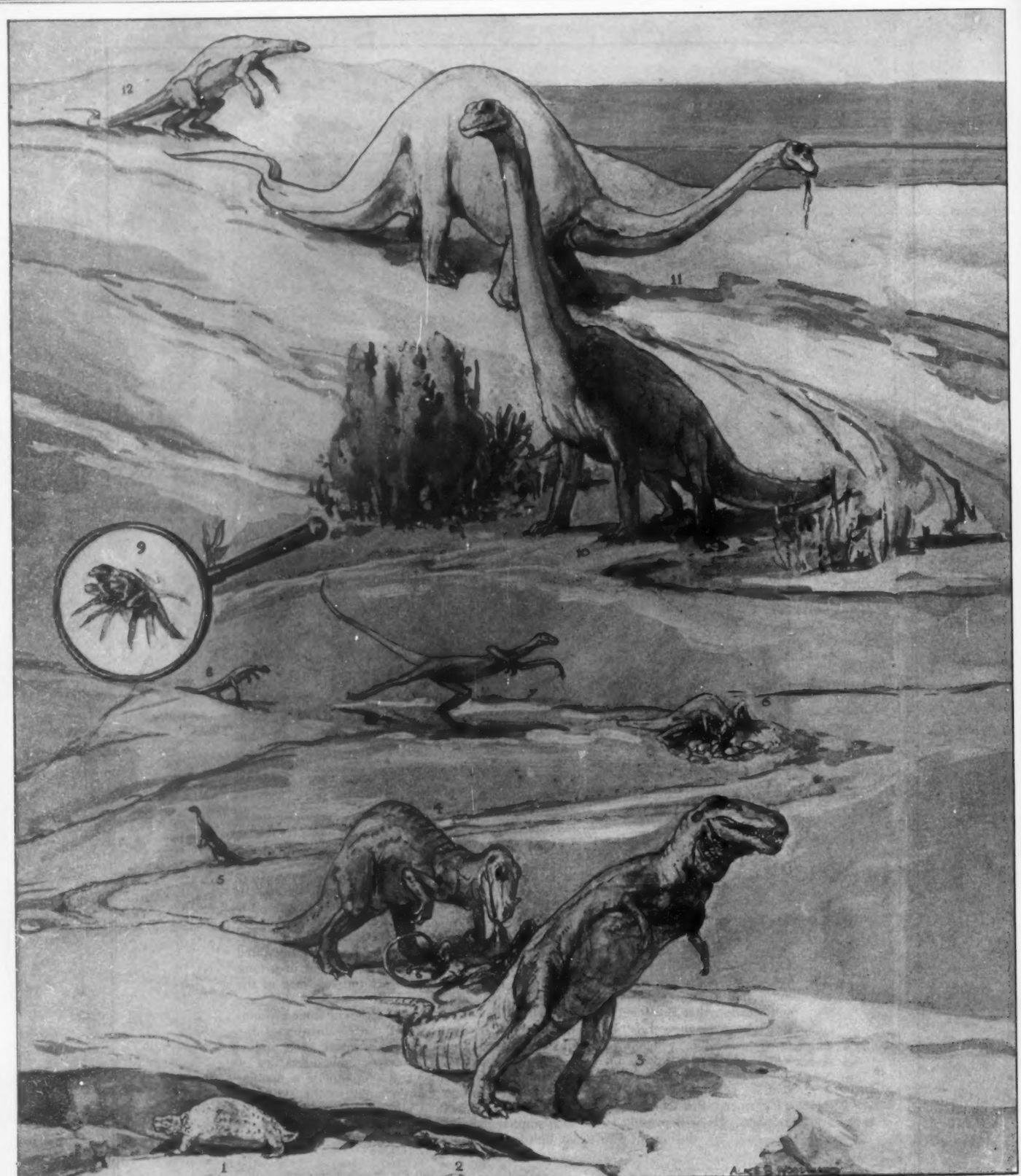


Wide World

Two Leaders of American Science

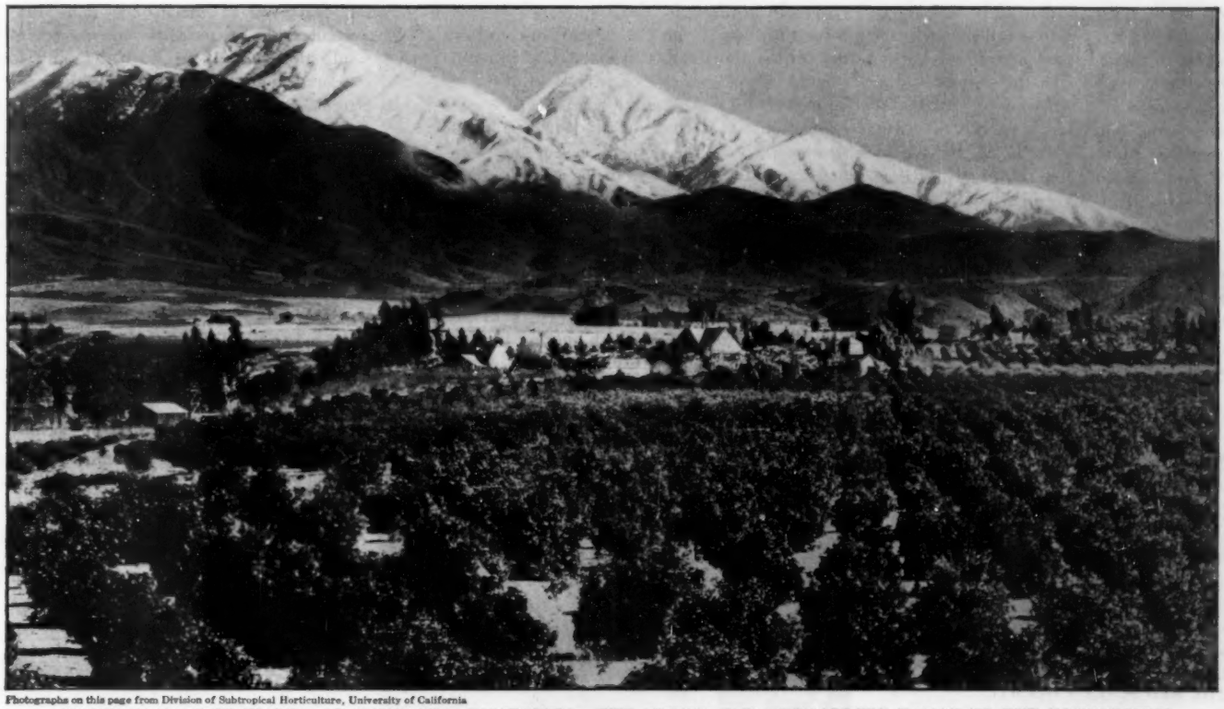
On the left, Dr. Liberty Hyde Bailey, President of the American Association for the Advancement of Science; on the right, Professor Michael I. Pupin, retiring president of the same great association. Professor Pupin is perhaps best known to the American public as the author of the recent book, "From Immigrant to Inventor," the story of his own romantic career which began as a Serbian shepherd boy. Dr. Bailey is a horticulturist and author. For many years he was Director of the noted College of Agriculture at Cornell University. He is the author and editor of a long list of encyclopedias and other books, not alone on horticulture but on some of the more philosophic aspects of life. Perhaps it was because he embodied this rare combination that President Roosevelt chose him Chairman of the now-famous Commission on Country Life, in an effort to get at the roots of the disabilities of the farmer at a time when farming was not regarded as the peer of other great industries. Dr. Bailey knows farm life, and he was able to interpret the difficulties of the farmer to the rest of the world in so understanding and sympathetic a manner that he is now considered to have brought about a great change in the status of the farmer. But those who know him personally regard him as a thinker and philosopher. He will preside at the next annual meeting of the Association, to be held during the Christmas holidays, in Nashville, Tennessee.



Drawing by Alice B. Woodward, courtesy of the *Illustrated London News*

Extinct Dinosaurs of the Great Age of Reptiles, 150,000,000 Years Ago

Brachiosaurus (10, above) was probably the largest quadruped that ever lived, while Cetiosaurus (11) was nearly as large. Megalosaurus (4) was 20 feet long. Tyrannosaurus (3), the fiercest and most terrible, was 18 feet high. However, not all dinosaurs were immense: Plateosaurus (12) was 14 feet long; Struthiosaurus (7), 13 feet long; Pariasaurus (1), nine feet long; Cynognathus (2), six feet long; Compsognathus (8), five feet long; and Anchiosaurus (5), five feet long. Oviraptor (6) was an egg-stealer. Finally, Scleromochlus (9) was only nine inches in length. Despite the fact that artists often depict the dinosaurs as contemporaneous with ancient man, they were extinct 70,000,000 years before man evolved.



Photographs on this page from Division of Subtropical Horticulture, University of California

NAVEL-ORANGE ORCHARDS AT HIGHLAND, CALIFORNIA; THE SNOWY SAN BERNARDINO RANGE IN THE BACKGROUND

Highland is in San Bernardino County, which lies immediately east of Los Angeles and Orange Counties. In 1925, these three counties, whose chief source of wealth is the growing of citrus fruits, spent about 2,000,000 dollars fighting pests that prey on fruit. It was a good investment

The Cost of Oranges

Few People Realize the Endless Efforts the California Citrus Fruit Growers Have Made and Are Still Making to Fight the Pests that Attack the Oranges We Eat

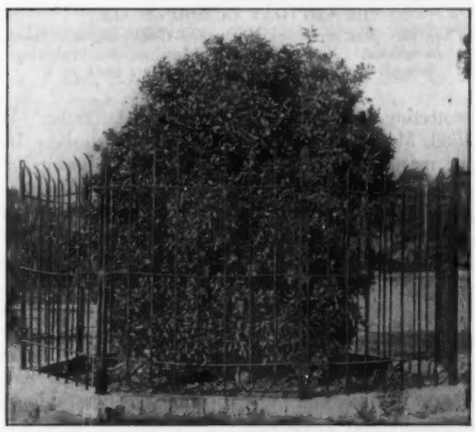
By T. D. A. Cockerell

Professor of Zoology, The University of Colorado

WHEN we speak of the cost of anything, we are apt to think, in our superficial way, of the price we paid at the grocery store. Is not that the real cost, covering every phase of production? How could the produce be sold on any other basis? It is a matter of statistical evidence that in California during the five years preceding 1913 the average box of lemons was sold at a loss of about 20 cents; yet lemons are considered highly profitable. The insufficient *average* price is of course due to the fact that while some made money, others failed. The customer does not pay for the failures, due to poor methods and bad judgment for the most part, when buying the fruit. He does pay for them in other ways: in general business depression, and his ultimate obligation to take care of those who cannot take care of themselves.

Some years ago I was being driven through Orange County, California, and suddenly I saw before me a handsome and attractive building of large size. I presume, of course, that is the residence of some wealthy orange grower. By no means, came the answer, it is the Orange County Poor House. All praise to Orange County, which can afford to do such things, and does them so well—but we pay for the loss on the lemons. This is one side of the picture, but there is another and more attractive one. I heard of a man who sent his son to Harvard, and boasted that he "paid tuition in full," he "did not propose to have his boy educated at other people's expense, or by charity," and so forth. A friend took him aside, and proceeded to show him how pitifully small was his contribution, in comparison with what his son was really getting. Were he actually obliged to pay in full, even his well-furnished purse would be wholly inadequate. It is quite the same with the oranges; we never can fully know, and certainly never can pay, what they really cost.

The subject would lend itself to treatment on the stage, or in some ways, more readily on the screen. We present the topic herewith to ambitious producers. The first picture might show the wild citrus of prehistoric times growing in Oriental forests. Then the slow and patient development by the Chinese; the Crusaders arriving in Palestine, and being shown the golden fruit; the Portuguese mariners crossing the Atlantic, carrying the orange to Brazil, and thereby unknowingly laying the foundations of prosperity in a California yet to be; the Franciscan padres, led by Junipero Serra, whose statue may today be seen in Golden Gate Park at San Francisco (coming up the coast, they built their missions, planting orange seeds and establishing horticulture in Upper California); United States control, and the development of great orchards on a modern basis; Mrs. L. C. Tibbet arriving in Riverside in 1873, with two little trees of the navel orange, presented to her by Mr. William Saunders of the Department of Agriculture in Washington (these trees were obtained from Bahia, Brazil, where the variety was well known); the Riverside Citrus Fair of 1879, when the Bahia or Washington navel was first exhibited, and attracted much favorable attention; the rapid growth of the industry; the meetings of the growers to protect their interests; the great cooperative plans, which, while leaving the individual free to reap the profits due to his care and industry, prevent him from adopting practices, or neglecting to adopt practices, in such manner as to hurt the whole community. Then the child of the city, on a hot day, refreshing himself with an orange, and offering sections of it to—I suppose Mary Pickford. Also, somewhere, certainly a picture of one of the original Bahia navel trees at Riverside, as I saw it myself last summer.



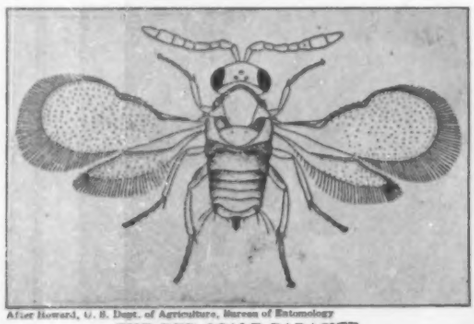
PARENT OF MANY MODERN ORANGE GROVES

This is one of the Tibbet Washington navel-orange trees planted in Riverside in 1873. From it sprang many of the present orange groves in California

It is such a good story that I really regret I am not a "producer." But there is a villain in the play; indeed, a whole series of them. Citrus trees are extraordinarily subject to the attacks of pests, both insects and fungi, and also to diseases apparently due to malnutrition. Merely to mention them all

would take too much space, and would not interest the reader, but a few deserve to be discussed. A very handsome scale-insect, of comparatively large size, the white egg-sac fluted like the columns of a Greek temple, appeared in California in 1868. At first it infested acacia, but later it spread to citrus trees and many other plants. Mr. R. H. Stretch of San Francisco sent specimens to Dr. C. V. Riley, then State Entomologist of Missouri, in 1872. The insect was then unknown to science, but it was not described by Riley.

Years passed by, and Dr. Purchas of Auckland, New Zealand, found specimens of the same insect on Kangaroo Acacia in that locality. He handed them to Mr. W. M. Maskell, Registrar of the University of New Zealand, who was then beginning the study of scale insects. Maskell at once perceived that they were closely related to the *Icerya sacchari*, a serious pest of sugar cane in Mauritius. He accordingly described the species, in 1878, as *Icerya purchasi*, by which name it has been known ever since.



After Howard, U. S. Dept. of Agriculture, Bureau of Entomology

THE RED SCALE PARASITE

This very minute insect parasite, Prospaltella aurantii *(Howard), destroys the red scale which, by natural selection, has developed races resistant to cyanide fumes*

It was realized that neither California nor New Zealand was the native home of the *Icerya purchasi*, and presently it was traced to Australia, whence it originally came. In California it continued to spread, and became known as the Cottony Cushion-Scale, or Fluted Scale. By 1887, C. V. Riley, then United States Entomologist, was obliged to declare: "The pest has come to stay. No human endeavor can exterminate it." He hoped, however, that it would not be an unmixed evil: "This insect has made profitable orange-growing on the Pacific coast more difficult and more of a science; but, by making it impossible at the same time for the shiftless to succeed in their business, it will come to be looked upon as a not unmixed evil."

This optimistic state of mind vanished as the scale, in spite of all remedies applied, actually threatened to destroy the citrus industry of California. It was then remembered that in Australia it was not deemed a serious pest, and the principle of biological control was invoked.

All insects, if left to multiply unhindered, would soon overrun the earth and eventually, at no distant date, perish themselves from lack of food. Under normal conditions, a balance exists between the rate of reproduction and the rate of destruction, so that each kind of insect maintains its numbers, without undue increase or decrease, from year to year. But imported into a new country, it may be that the natural enemies have been left behind, and consequently the balance is disturbed. This had happened to the Fluted Scale, and now it was asked, could we go to Australia and find there the needed natural enemy?

The United States Commissioner of Agriculture appealed to Congress for authority to send an agent to Australia to look for the desired enemy of the scale. Probably the legislators, totally ignorant of entomology, thought the request absurd, and they turned it down. The Commissioner could not act on his own authority, because the law did not permit him to spend money for investigations outside the United States. As it happened, there was to be an exposition at Melbourne, and it was found practicable, through the good offices of the Secretary of State, to send an agent to the exposition. Mr. Albert Koebele was selected, and was told by the Commissioner of Agriculture to "make the most careful investigations wherever you can learn of the occurrence of *Icerya*, and find as many of its natural enemies in Australia as possible. Find out also the periods at which these parasites oviposit, and ascertain the season at which success in importation will be most likely with each and all of them."

Koebele sailed August 23, 1888. The matter looked sufficiently promising during the year to justify sending another entomologist to assist in protecting enemies of the scale, so on December 15, 1888, Mr. F. M. Webster sailed for Australia. In the meantime Koebele had made two shipments of natural enemies; the second included at least 12,000 healthy individuals. Unfortunately the boxes were injured enroute and there was much delay at the custom house, almost resulting in complete failure. In the course of time both parasitic flies and Lady-bird beetles were safely received at Los Angeles. There was, particular, a red and black lady-beetle *(Rodalia cardinalis)* which attacked the Fluted Scale with great vigor. Mr. D. W. Coquillett, who had charge of things at the California end, was able to report by May 1, 1889:

"In several of my previous letters to you I have expressed my belief that the red- and-black Lady-bug from Australia would prove more effectual as a destroyer of the *Icerya* than any of the other predaceous or parasitic insects recently introduced into this state from Australia, and I am now able to state definitely that such is the case. The orange tree covered with a tent at Mr. Wolfskill's in this city (Los Angeles), where I colonized the first two or three consignments of these Lady-bugs, is now almost entirely free from living *Iceryas*, while on the adjoining trees many larvae of this Lady-bug are now busily engaged in destroying these pests, and already the good work accomplished by them is apparent to the most casual observer. I have also colonized them in several localities in this part of the state, and in every instance the attempt has proved successful, the Lady-bugs apparently thriving quite as well here as they would in their native land."

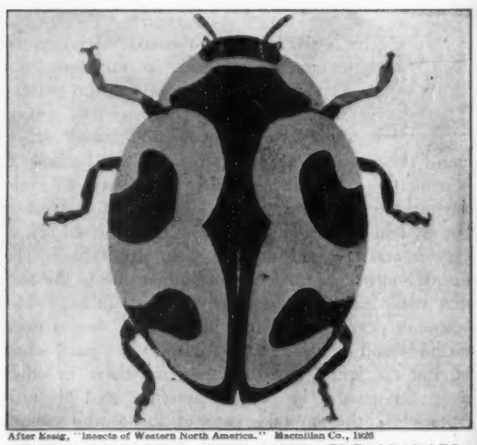
After Essig, "Insects of Western North America." Macmillan Co., 1926

THE COTTONY CUSHION-SCALE

When this pest mysteriously invaded California, it refused to be ousted. The lady-beetle shown on the right was brought from Australia and made short work of it

In July, 1889, Mr. J. R. Dobbins of San Gabriel reported that the lady-beetle had "multiplied in numbers and spread so rapidly that every one of my 3,200 orchard trees is literally swarming with them. . . . I feel positive from my own experience, that the entire valley will be practically free from *Icerya* before the advent of the new year." Success was practically complete, and today it is possible to say that the Fluted Scale as a serious pest of citrus trees in California is a thing of the past.

In 1913 it was discovered that a number of orange groves near Uplands, California, were infested by a peculiar kind of mealy-bug, a member of the scale-insect family. At first it was supposed that it was the well-known native Baker's mealy-bug, but more careful investigations by Mr. C. R. Clausen of the California Citrus Experiment Station showed that this was not the case. In fact, no description of it could be found anywhere, so Clausen named it the Citrophilus mealy-bug *(Pseudococcus citrophilus)*. Where it came from, and how it reached California, was a mystery. All this was set forth in a Bulletin published by the University of California, September, 1915.



After Essig, "Insects of Western North America." Macmillan Co., 1926

THE LADY-BEETLE THAT SAVED THE ORANGES

Adult female of Rodalia cardinalis *(Mulsant), the beetle that exterminated the cottony cushion-scale. The light areas are red; the others, black*

About a year later than the California discovery, Mr. C. J. Gahan, the well-known authority on beetles, discovered a strange mealy-bug on red-flowered currant in his garden at Bedford Park, London. He handed the specimens to the English authority on scale-insects, Mr. E. E. Green, who described them as a new species, *Pseudococcus gahani*. This was published in June, 1915, and so has priority over Mr. Clausen's designation, which we now know refers to the same species of insect. The common name Citrophilus mealy-bug is appropriate, and is still used. *P. gahani* seems to have become rather frequent in the vicinity of London; I found it close

to the door of the herbarium building at Kew Gardens.

The appearance of this new pest in California and England at about the same time is curious enough, and as we do not know the place of origin, no explanation can as yet be given. The mealy-bugs are difficult to study, and entomologists have rather avoided them; but it is evidently a matter of great practical importance to know what kinds inhabit every land.

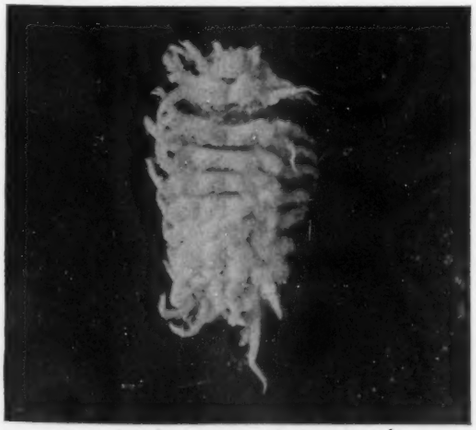
In Southern California, this Citrophilus mealy-bug has become such a dangerous pest over a large area that it is believed by experts that it would utterly destroy the orchards if left unchecked. It is repeating the performance of the Fluted Scale, or would do so if given a chance. Fortunately it is attacked by certain parasites, but especially by the lady-beetle *Cryptolaemus montrouzieri*, which has been called the mealy-bug destroyer. This beetle was obtained in Australia by Koebele in 1892, and its immature or larva stage looks very like a mealy-bug.

Last summer I was taken by Mr. H. S. Smith to see the insectaries in the vicinity of Los Angeles and Riverside, where the *Cryptolaemus* beetles are being raised in vast numbers on mealy-bugs living on potato sprouts in darkened rooms. This method, devised by Mr. Smith himself, makes it possible to produce many thousands of the beetles, which fly to the windows, and are readily captured. They are put in little gelatin capsules, such as may be obtained in any drug store, and liberated at the rate of ten to a tree each year. The result is adequate control of the pest, but of course at heavy expense. The *Cryptolaemus* will not winter successfully in California, so it has to be recolonized on the trees at frequent intervals.

Great efforts are being made to obtain a better natural enemy, which will go through the winter without loss. Entomologists are at this moment searching various countries, as for instance, South Africa. The consignments of insects as they arrive at Riverside (Citrus Experiment Station) are examined in a special building with double doors, every precaution being taken to avoid liberating any of them until their true nature is known. This is particularly important, because in the past some very good parasites have been rendered inefficient by the accidental introduction of *their* natural enemies, called hyperparasites. Thus it is essential, not only to take great precautions, but also to have a precise and critical knowledge of the various insects involved.

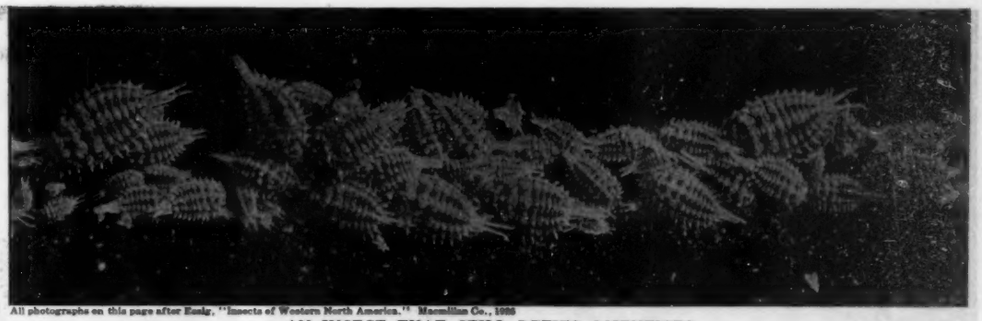
THE AUTOFUMER

In this machine the liquid hydrocyanic acid or prussic acid is first heated by the exhaust of the engine before being conducted under the fumigating tent. This volatilizes it, converting it into gaseous form. This gas is extremely poisonous, yet the black scale and the red scale have actually evolved races that can resist it. This is brought about by natural selection: the races of scales which are resistant, reproduce their kind; the others die without reproducing



THE MEALY-BUG DESTROYER

Larval stage of Cryptolaemus montrouzieri *(Mulsant), which is being raised to control the mealy-bug. As it will not survive winter weather, it must be recolonized each spring*



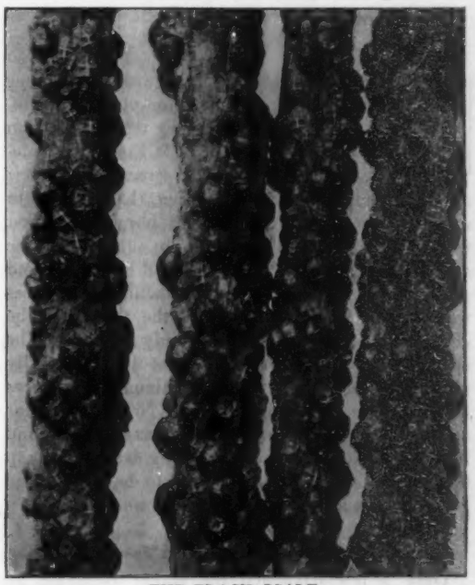
All photographs on this page after Essig, "Insects of Western North America." Macmillan Co., 1926

AN INSECT THAT STILL DEFIES SCIENTISTS

The citrophilus mealy-bug is another unsolved problem. For about ten years this pest, Pseudococcus gahani *(Green), has challenged California fruit growers. A world-wide search for an effectual natural enemy is now being conducted*

The above account only partly sets forth the troubles of citrus growers from scale insects. Two well-known kinds, the black scale *(Saissetia oleae)* and the red scale *(Chrysomphalus aurantii)*, have long infested the orchards. After many experiments, it was found that they could be efficiently controlled by fumigation, under tents, with hydrocyanic acid gas. The technique was perfected so that the problem was considered solved, except so far as it involved heavy annual expense. But of late, following Darwinian principles, the scales have shown the effects of selection and the survival of the fittest, and have actually developed races resistant to the deadly cyanide fumes, or to such strengths of them as will not injure the trees.

Dr. H. J. Webber, Director of the Citrus Experiment Station at Riverside, took me to the orchards controlled by the Station, and showed me how the various investigators were dealing with problems of irrigation, fertilizers, varieties, diseases, and other matters. What is the true nature of mottled-leaf disease, and how may it be controlled? Dr. Webber pointed out the bad results from unwise selection of rootstocks on which to grow the trees; he held that the varieties of stock should be minutely studied, to determine their precise value. Mr. E. T. Bartholomew was studying the effects of fungi, and of lack of water. He found that the fruit served as a sort of reservoir for the tree, supplying the branches and leaves with liquid when it could not be obtained from the roots. Studies were being made of cover crops. Dr. Webber himself is specially interested in a detailed study of the species and varieties of the citrus trees. No one can see the work of such a Station without being impressed by the fact that there is a line of expert scientific men standing between our use and enjoyment of the products of the soil and the enemies which threaten them. Not only are we indebted to science for the maintenance of what we have, but added bounties are thrust upon us. Better and cheaper products, profiting equally the producer and consumer. The cost cannot be estimated in money; human qualities of intelligence and good will have been placed at our service, and the more they are worth, the less we have to pay.



THE BLACK SCALE

Saissetia oleae *(Bernard), a colony of females on oleander branches. The method shown in the illustration at the left forms a fairly satisfactory control for this pest*

In 1925 the money value of the oranges and lemons in California was 79,200,000 dollars. Los Angeles County spent about a million dollars fighting pests; Orange County about 900,000. Without these efforts, the vast industry would be ruined, and all of us in various degrees poorer for it.

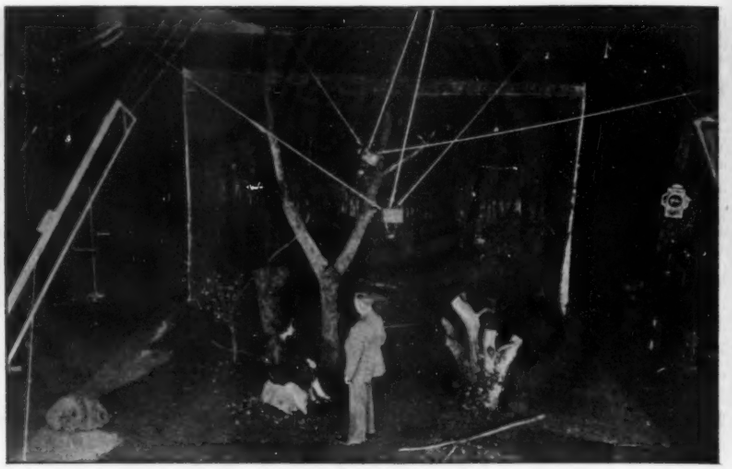
I have written only of California, because personally familiar with the facts in that region; but a similarly interesting story might be told of Florida and the south.

In order to determine whether foreign plants can be profitably raised in the United States, there has been established, at Arlington, Virginia, a testing farm for just this purpose. The farm and some of the work accomplished on it will be described in our July issue.

All photographs courtesy of Vitaphone Corporation

READY FOR THE RECORDING PROCESS

A specially designed, noiseless arc light is in the right foreground. Note the enclosure for the camera. This booth is soundproof so camera noises will not be recorded



A PARTIALLY COMPLETED SET

Two sensitive microphones are hanging in the center. These are connected to the recording apparatus, which may be located anywhere in the studio, regardless of distance

Giving a Voice to Motion Pictures

The Problem of Synchronization Has Been Solved. Good Sound Reproduction Has Made One System Practicable

By A. P. Peck

IT was about 14 years ago that the writer sat in a small motion-picture auditorium, eagerly awaiting the presentation of a "talking movie." Finally the picture flashed on the screen, and a few seconds after one of the characters had started to move his lips in the introductory phrases, his first words issued from a phonograph situated on the stage near the screen! Someone had blundered and as a result, all through the production, the voices were always a few paces behind the actions of the characters. Nor was that the only trouble. The speed of the phonograph had not been carefully regulated, and as the action continued, the voices fell more and more in arrears. Next, the motor spring became weak and it was necessary to wind it up, with the usual accompanying noise. To cap the climax, the voices continued to be reproduced for several seconds after the picture was finished.

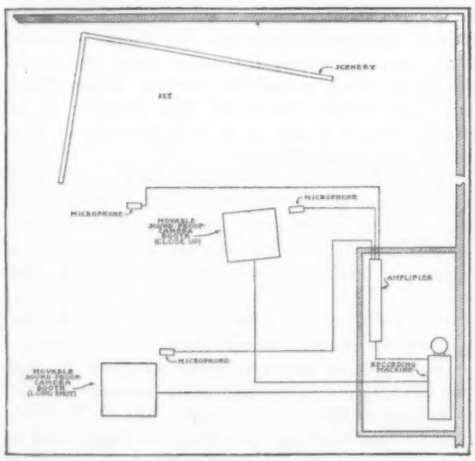
Experimental Stage Passed

Only a few days ago the author occupied an orchestra seat in a large New York motion-picture theater. The scheduled presentation started. Will H. Hays, "czar" of the motion-picture world appeared on the screen, and a voice perfectly in accord with the motions of his lips, greeted the audience. The "speaking movie" then introduced them to the first practical, commercial synchronization of motion pictures with voice and music that had outgrown the laboratory stage and invaded that most blasé of amusement centers—Broadway. And the perfect coordination of the sounds and the action was not the only astounding feature. The voice appeared to come directly from the speaker's mouth, and while the sounds had a certain mechanical quality, they were pleasing and not at all as tiresome as the monotonous reproduction from a phonograph.

Thus is briefly told the comparison between one of the first attempts at "talking movies," as they are popularly called, and the present-day production. But between these two, one can find years of painstaking research on the various phases of the subject, all of which had to be perfected before satisfactory results could be obtained.

The writer has collected material on the various systems of recording and synchronizing sounds with motion pictures and in succeeding articles will tell of them in detail. The present article will be confined to a description of the only system that has been commercialized and promoted to the point where any theater manager desiring to install the necessary equipment can have the work done and be assured of a steady supply of pictures and synchronized voice records. This system is known as Vitaphone, and has been made possible by the cooperation of Warner Brothers, motion-picture producers, the Bell Telephone Laboratories and the Western Electric Company.

Although the average person might think that the hardest problem in the production of this type of motion pictures would be the synchronization of the voice with the actions, this is in reality the simplest part. It is solved by ordinary mechanical and electrical means, much refined, and no great difficulties have been encountered. However, ordinary voice reproduction such as afforded by a phonograph, will not suffice for this work. There must be volume and plenty of it. There must be freedom from mechanical noises and the voices or music must be natural. Here was where the years of research were spent.



SCHEMATIC STUDIO LAY-OUT

The essential apparatus for the filming and recording of a Vitaphone production are shown here. The cameras and microphones are subject to change to obtain best results

A method of recording and one of reproducing, all with a minimum of mechanical or other extraneous noises, had to be developed. To meet the requirement of controllable volume, vacuum-tube amplifiers, for use both in recording and reproducing, had to be designed. Then these had to be linked with the synchronizing features to produce the perfect whole—an assembly of apparatus that would deliver the required results and still be so simplified that the reproduction part could be put in any theater and run by any operator, after he had received a few simple instructions.

That all of the requirements have been met in Vitaphone can no longer be doubted. It has been installed in various theaters throughout the east and in all cases has been accorded a welcoming ovation.

Vacuum Tubes Play Important Role

Let us now turn to the mechanical features of the type of talking motion picture that is treated in this article. In essence, there is a wax record in which the voice or other sound vibrations are cut. This record is run at a constant speed and so linked to the motion-picture projector that there is no possibility of the two mechanisms being thrown out of synchronization. The variations in the grooves are translated into movements of a needle, and these in turn set up fluctuations in an electrical circuit which correspond with the original sound waves first recorded. The current is then amplified and used to actuate a loudspeaker.

In actual practice, stage settings are made much the same as for the filming of regular motion pictures. There are, however, some details in this work which must be attended to that are not necessary when sound recording is not to be attempted. For example, the acoustics of the studio must be correct in order that the final reproduction have neither flatness nor the hollowness caused by excessive echoing. The proper acoustics are obtained by the place-

THE CAMERA BOOTH

The padded walls confine the noise of the mechanism. Note the stroboscope and its neon lamp just below the lens board

ment of draperies and long strips of composition board at strategic points throughout the studio.

The sounds that are to be recorded on the wax record are first picked up by microphones. In some scenes, only one of these delicate mechanisms is necessary. Where the action is spread over a comparatively large area, and the characters cannot be closely grouped, two or more microphones are used.

Wires from the microphones are led to another part of the studio where the actual sound recording is to take place. Here the sound currents are sent through a practically distortionless vacuum-tube amplifier. Emerging from this, greatly reinforced, they are made to actuate an electrical recording mechanism. This device is provided with a chisel-like stylus that, resting in a groove on the revolving wax disk, vibrates in accord with the sound currents and cuts lateral gouges in the wax. To insure smooth running, a "vacuum cleaner," which draws away all of the shavings, is located above the stylus.

It is interesting to note that the record in this work is used in just the reverse manner from that of an ordinary phonograph. The stylus travels in the groove from the center of the record to the outer edge. According to one of the engineers of the Vitaphone Corporation, this is done because it is found that the stylus "tracks" better and a more accurate record is obtained in this way.

The soft, wax records that are first made are always produced in duplicate. Two and sometimes more will be made for one scene so that the best can be chosen as the master. This is then processed in the same way as ordinary phonograph records, and many duplicates are made.

During all of the time that recording is taking place, a monitoring system is in use. This consists of a loudspeaker and auxiliary apparatus, by means of which it is possible for the engineers to check up on the quality of the electrical "sound" fluctuations that are being delivered to the recording mechanism and so to eliminate quickly any defects in pick up, transmission or amplification.

At the time that the sound record is being made in the recording room, the pictures are being taken in the studio. The cameras are run by synchronous motors operated on the same circuit as a similar motor that turns the disk in the recording room. Because of this electrical linkage of the parts, the making of the pictures and of the sound record is always in step—synchronized, in a word.

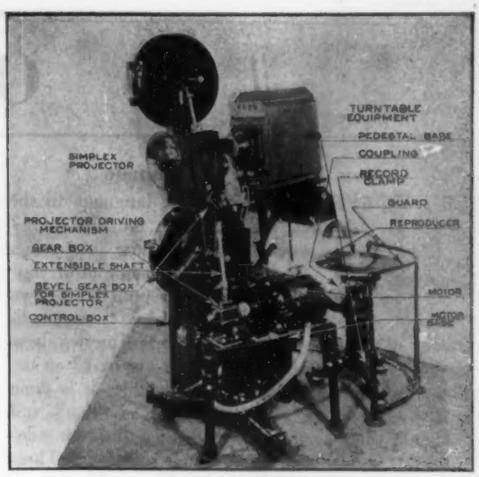
Before the actual work is started, the camera is threaded with film, a marked frame being put in place in the camera gate. The recording stylus is set at marked point on the record and the two motors are started from rest and run to synchronization. An elaborate signaling system between the attendant at the recording machine, the director and the camera man enables each one to know just what the others are doing.

What It Means to the Public

In order to keep a check on the synchronization of the mechanism, two forms of stroboscopes are used. In one case, this takes the form of a disk about two and one-half inches in diameter divided into several parts, like slices of pie. These are colored alternately black and white. A neon tube operating on the same alternating current as the rest of the apparatus, sheds its light on the disk. The light pulsates in accord with the fluctuations of its actuating current, although these fluctuations are invisible to the naked eye. If synchronization is correct, the whirling disk will appear to the eye of the attendant to be stationary. This is because of the fluctuations of the light falling on the disk, and the relationship of the speed of these changes to the size of the divisions on the disk and the disk's speed.

A similar stroboscope is attached to the camera-driving mechanism. Another type also is used at the recording end, wherein the edge of the turn-table is divided into black and white sections that appear to the eye to be stationary under the proper conditions, as explained above.

In the projection of these pictures and their accompanying sounds, the process of synchronization is very simple. The turn-table carrying the disk is on the same motor shaft that drives the mechanism of the projector. Again a marker on the film is put in its proper position, the stylus of the reproducer is placed by its own mark and the motor is started. Here it is impossible to lose synchronization.



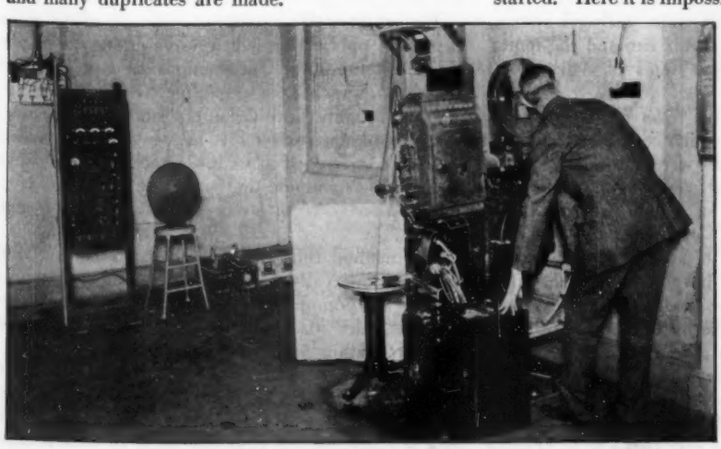
THE PROJECTOR

This is a standard type, equipped with the extra apparatus necessary for the presentation of a "talking motion picture"

When the reproducing stylus is actuated, a fluctuating current is generated. This is amplified by vacuum tubes and then sent to the loudspeakers. These are usually four in number. Two are located above or behind the screen and two in the orchestra pit. The former are employed when the characters on the screen are speaking or singing, while those in the pit are used when the mechanism is reproducing the proper incidental music for the type of picture being shown.

With the widespread distribution of synchronized sound records and motion pictures, the greatest musical and histrionic artists can be brought to the masses, at a reasonable cost, and in a form more nearly approaching a personal appearance than has ever been heretofore possible. Furthermore, the better musical and dramatic plays will be available and the educational possibilities are almost unlimited.

Even at the present early stage of the development, feature pictures are being shown to the public in over 100 theaters. In these pictures, the synchronized sound is used for the music accompanying the action, and not, in the main, for spoken words in drama. Speaking and singing are attempted as yet only in isolated scenes. It is, however, further planned to extend the activities and shortly release a popular musical drama which has had a large success on the legitimate stage. Soon straight drama will be tried, and here we will see action and hear the regular dialogue of the stage, with the added advantage of unlimited stage settings that only motion-picture productions of the present-day type can give.



IN THE PROJECTION ROOM

The projector is shown at the right. To the left of the photograph is a monitoring loudspeaker and the amplifier for reinforcing the reproduced sound currents

IN THE RECORDING ROOM

The operator at the left is watching for inaccuracies in the cutting of the record. The panels at the right hold the vacuum tubes and amplifying apparatus

Our Point of View

How Language Is Unmade

HAVE you ever watched language in the making, or, rather, in the unmaking? The process is really quite interesting, and you do not have to step out of your way to see it. Every people has its own tendencies or predilections in the making or modification of its spoken language, and in America these tendencies, it need scarcely be said, are based on the desire to "speed up" speech. Sometimes it is done by the elimination of words, such as "that" and "which," where long-established usage on both sides of the Atlantic would demand their retention. Thus, in place of "this is the book that I wanted," we now get, "this is the book I wanted." Which of these sentences is correct? Make a canvass of your friends, as we have done, and doubtless you will find a consensus—we are referring now to people of education—that in such a sentence common practice justifies the elimination of "that" in speech and its retention in correspondence or on the printed page. "On top" in place of "on the top" is becoming increasingly common, both in speech and writing, and bids fair, on this side of the water, to become the universal practice.

But it is in the pronunciation of individual words that the process of cutting down or shortening up is most marked, and we venture to say most unpardonable. "Goin" for "going" is so widespread among English-speaking people as to render any reference to the shortening up of the word superfluous; but how many among your friends, good readers, are guilty of the elimination of the second "f" in the word "fifth"? "Fith" Avenue is so common as to be first cousin in this respect to "goin"; and the next time you are in hurried conversation, watch your step to see whether you do not catch yourself saying "twenny" for "twenty." And if you stand self-convicted, it may be "nooze" to you, but it will not be "news" to your friends.

Of two people, one of whom it is difficult to understand, and the other easy, you will find that the clear speaker is he who snaps in his consonants sharply. The sloppy speaker sounds his vowels, but his consonants rarely, if ever.

Economy of effort, we are continually reminded, is one of the secrets of our industrial and commercial success, but let us beware of applying it too freely to the written and spoken word. The surest safeguard is most careful training in the nursery, the kindergarten and the home life of the growing generation.

The Motor Bus and the Railroads

WE are all aware that the amazing growth of the automobile, and especially of the motor bus, have been cutting into the passenger carrying business of the railroads; but we doubt if any, except those who are rather intimately concerned with the operation of the railroads, have any idea how deeply the new method of transportation has cut into the annual returns. The railroads, be it remembered, recently claimed for themselves all people who traveled any distance greater than could be comfortably covered by the time-honored horse and buggy. Let us, therefore, draw your attention to the following summary of the situation, based on the statistics of the Interstate Commerce Commission for last year.

The total number of railroad passengers has declined from its maximum in 1920 by 15 percent in the district more or less adjacent to the Great Lakes, and as much as 68 percent in what is known as the southwestern region. The latter roads in 1920 carried some 67,500,000 passengers, whereas last year they carried about 21,550,000. There has been a decline of 22 percent carried in the whole eastern district and a decline in the southern district of 42 percent and in the western district 47 percent. As was to be expected, the railroads have lost out largely in the short-haul business, and, applying the distance traveled to the above figures, we find that the drop in the number of passengers carried one mile in the east has been 15 percent, in the south 21 percent and in the west 38 percent—the total figures for the whole country showing an average loss of 25 percent.

Now, translate these statistics of the passenger business into terms of dollars and cents and we learn that last year the eastern group of railroads lost 91,400,000 dollars; the southern group lost 46,400,000 dollars and the western group 207,000,000 dollars—the total losses of our entire railroad system, due to the inroads of the motor car and the motor bus reaching the stupendous total of 345,000,000 dollars.

More than once since the War we have drawn attention to the great task which confronted the railroads when their properties were returned to them by the Government several years ago. Not much had been done in the way of keeping the tracks up to standard requirements, and not only were the roadbeds, ties, steel rails, et cetera, run down, but the equipment itself was in poor condition. The great James J. Hill, if we remember rightly, estimated that it would take five billion dollars to bring our railroad system up to a state of full efficiency. Another burden that confronted the railroad in those perilous years was the enormous increase which had taken place in the pay of the employees.

The only way to save the railroads was to practice the most rigid economy and thoroughly revise well-established railroad practices. The task has been nobly accomplished. Locomotives more powerful and more economical have been designed, loading per car has been greatly increased, the track has gradually been brought up to first-class condition and many of the leading railroads have reached the dividend-paying basis of 5¾ percent, which the Government demanded before they could go into the market for the flotation of greatly needed securities. Now, as we see, the railroads are confronted with a further enormous loss of 345,000,000 dollars in their passenger business.

With commendable foresight, many of the roads have gone into the motor bus and motor truck business themselves and have established large fleets of trucks and busses, thereby enabling them to cut out many short-haul and unprofitable trains and to regain much of the freight and passenger business which was slipping out of their control. Let us give credit where credit is due, and try to get rid of the held-over prejudices against the railroads, that have come down as a burdensome heirloom from an era of reprehensible practices.

Perry B. Turpin

It is with deep regret that we record the death of Mr. Perry B. Turpin, a member of the firm of Munn & Co., at the close of 42 years of active association with that firm and with the Scientific American—during the last ten years of which he acted as resident manager of the Washington office. A native of Washington, Mr. Turpin was educated in the public schools and was graduated in law at the old Columbian College. The deceased had extensive Masonic affiliations, being a member of LaFayette Lodge, F. and A. M.; Columbia Commandery of the Knights Templar and Almas Temple of the Mystic Shrine. He was also an active member of the Kiwanis Club. Referring to his social activities, Mr. Turpin was possessed of an unusually fine tenor voice and will long be remembered for his musical work in Washington and elsewhere. But above all, his business associates and his friends will remember him for his charming personality and a genial and kindly disposition, which won for him instant welcome wherever he went.

A Warning

THE spectacular fire which raged so menacingly in and around the tower of the Sherry-Netherland apartment-hotel recently should be taken to heart by the Building Department and the contractors as an object lesson. The fire started in the upper stories, on the outside scaffolding which was built several hundred feet above the street, for the masons who were enclosing the steel work. It swept around the four sides of the tower until the total mass, covering several of the upper stories, was a raging furnace. The firemen were powerless, for the reason that no sufficient pressure and volume of water were available through the standpipe, and there was nothing to do but leave this gigantic torch to burn itself out.

There are two outstanding lessons—one of warning and the other of assurance. That of assurance comes from the fact that, in spite of the magnitude of the fire, we are assured that no permanent injury was done to the structural steel frame-work of the building, which was of the most up-to-date and approved fireproof construction. The warning concerns the standpipe and water-tank facilities. Although these will be ample for the protection of the building when it is completed, apparently the construction and equipment of the fire system did not fully keep pace with the upbuilding of the tower.

We are in entire agreement with the editor of an insurance publication, when he describes this as the finest test fire-proof construction has ever had, and that had there been a standpipe available, the fire would probably have been put out with despatch. Because of the extremely heavy pressures which would be developed in its lower sections, no attempt is made in standpipe and pumping construction to pump directly from street level to the uppermost stories.

The method followed is to place large receiving tanks at intervals throughout the height, and distribute the pumping plant so that it has merely to lift the water to a limited height. This keeps the pressure within practicable limits.

So completely incombustible is the modern office building that one may work on the fiftieth or one hundredth floor with the assurance that so far as fire risk is concerned, he is as safe as if he were located at street level. A local fire can now be confined to the floor on which it originates.

Three Coming Events

An Eclipse of the Sun, One of the Moon, and the Arrival of a Comet Will Keep Astronomers Interested During the Month of June

By Henry Norris Russell, Ph.D.

Chairman of the Department of Astronomy and Astrophysics, Princeton University
Research Associate, Mt. Wilson Observatory of the Carnegie Institution

THREE events of interest happen this month, and deserve our detailed consideration.

The first in order of importance, although not of time, is the total solar eclipse of June 29. Considered in the abstract, this would not be regarded as a very important one, for the moon's shadow extends only about a thousand miles beyond the earth's center, and, even when it reaches the surface, the shadow cone is so narrow that the eclipse lasts at most for only 50 seconds, and the eclipse track is at best about 40 miles in width.

If the weather is favorable, however, the eclipse is likely to be seen by a very large number of people, for the track crosses the central part of England, passing over a densely populated district.

The shadow first reaches the earth at a point in the Atlantic, west of the Bay of Biscay. Sweeping northeastward, and just missing the southeastern corner of Ireland, it comes to land in England, and passes over the crowded district of Lancashire, including Liverpool within its area. Crossing England diagonally, and traversing the North Sea it runs along the whole length of Norway, from near Stavanger to a point beyond the North Cape.

Many points along this part of the path are accessible to observers, but farther on it traverses a most desolate region in the Arctic Ocean, off the Siberian coast. Finally, it sweeps over the eastern end of Siberia, traverses Bering Sea, and leaves the earth in the North Pacific.

Observers Must Set Alarm Clocks

Of far less scientific importance but of more immediate interest to American star-gazers, is the lunar eclipse of June 15. This is total, although by a narrow margin, for the moon hardly more than dips fully into the northern edge of the earth's shadow, and totality lasts little more than 20 minutes.

The moon enters the penumbra, so that her eastern edge begins to be very slightly darkened, at 12:34 A.M. by Eastern Standard time (an hour later by daylight saving time) and first reaches the true shadow at 1:43 A.M. For the next hour and a half the eclipse increases, until the last glimmer of direct sunlight is cut off at 3:13 A.M. At 3:35 totality ends, and at 5:05 the moon leaves the shadow, although she is involved in the penumbra until 6:15. Practically the whole eclipse is therefore visible throughout the United States—although eastern observers will have to sit up inconveniently late to see it through, unless they are wise enough to use their alarm clocks, and get their night's sleep first.

The amateur observer will find much to interest him: the gradual weakening of the moon's light on the eastern side as she gets deeper into the penumbra; the much greater darkness of the umbra, which at first appears almost black; the visibility of the eclipsed portion of the moon by light refracted through the earth's atmosphere; the greater brightness, at the middle of totality, of the northern limb, which is nearest the edge of the shadow; and the gradual reversal of the same scene as the eclipse wanes.

The scientific observer may concern himself with the measures or estimates of the brightness of the eclipsed moon, which give interesting information about the transparency of the earth's atmosphere. Or, if he has at his disposal heat-measuring devices of a modern type, he may apply them to measures of the moon's radiation. As the sunlight is cut off, the short-wave radiation, which is only reflected sunlight, will decrease *pari passu* with the visual brightness; but the long waves, which are stopped by a water-cell, should continue to come in, since they are sent out by the moon's own surface, which, on the sunlit side just before the eclipse, is probably rather hotter than boiling water.

The chief interest of such measures will be to see how much this heat radiation falls off during the two hours or so during which the direct sunlight is cut off from a given portion of the lunar surface. This will tell us how fast the surface cools when radiating freely into space. We might expect a solid mass of rock to cool rather slowly; but if much of the exposed surface is covered with loose rock fragments and rubble, the rate of cooling should be much faster—so that there is here a chance to get really new information.

Photograph by Yerkes Observatory

MOREHOUSE'S COMET

This comet was discovered at Yerkes Observatory in 1908, by Dr. Daniel W. Morehouse, now President of Drake University at Des Moines, Iowa. Although faint visually it was bright photographically, its light being predominantly blue

The third event of the month is much more unusual than the others—the very close approach of a comet to the earth.

The comet in question is a small one—periodic, returning at intervals of about six years, and known as the Pons-Winnecke comet after two astronomers of earlier times, one of whom discovered it at its first recorded appearance, while the other detected its periodic character.

Like all other comets it has a very eccentric orbit—its minimum distance from the sun being 96,700,000 miles, while its maximum distance is nearly 610,000,000. When at perihelion it is opposite the point of the earth's orbit in longitude 268°, which the latter reaches on June 21. At this point the earth is 94,400,000 miles from the sun. If the comet's orbit were in the same plane as the earth's, the two tracks would be only a little more than two million miles apart; but it is inclined about 9°, and, in consequence at this point, the comet is almost 5,000,000 miles north of the earth's orbital plane. Ten degrees farther on in longitude, opposite the point which the earth reaches on July 1, the comet is in the plane of the earth's orbit; but here it is 600,000 miles farther from the sun than before, so that the minimum distance between the two bodies is 2,900,000 miles.

On the present occasion, circumstances are such that this minimum distance is almost realized. The comet comes to perihelion on June 21, in line with the earth and sun, 2,300,000 miles outside the earth's orbit, and 4,900,000 miles above it. Eight days later the comet will be in the plane of the ecliptic, and 2,900,000 miles beyond the earth's orbit. But, since it moves faster than the earth, it will have outrun the latter by about 2° of longitude, as seen from the sun, which corresponds to some 3,300,000 miles. All through this period, the two bodies will be very close together, the minimum distance of about 3,600,000 miles occurring on June 26.

Will the Comet Be Conspicuous?

When rediscovered at the present return by Van Biesbroeck at the Yerkes Observatory on February 27, the comet appeared as a very faint, small nebulosity of the 17th magnitude, and could be detected only on photographs of long exposure made with the powerful 24-inch reflector. At that time, however, the comet was about 175,000,000 miles from the sun, and 90,000,000 from the earth. When at its nearest to us, it should appear more than a thousand times brighter from mere decrease of distance, and if its intrinsic brightness increases rapidly as it gets nearer the sun (as so often happens with comets), it should become visible with a field glass, or even to the unaided eye.

It does not seem likely that it will be at all conspicuous; but the apparent brightness of a comet is one of the most risky things to predict in the whole range of photometry, since different comets behave differently, each being more or less of a law unto itself. It may be recorded, however, that on June 26 the comet will come to the meridian at about 3 A.M. and be about 6° north of the celestial equator. Its apparent motion in the heavens will be very rapid—southward and eastward—at the rate of more than 10° per day—almost as fast as the moon seems to move! Unfortunately, the waning moon will be not far away in the sky, and although her light will be feeble, it may do a good deal to drown out the comet's.

The amateur observer, therefore, may not find anything very remarkable to see—indeed, he may have trouble in seeing anything; but the fact that a visitor from the depths of interplanetary space has come so near us—within only one-seventh the minimum distance of Venus, and less than one-third even of that of Eros—will nevertheless be memorable.

WHALE GUNNER READY FOR ACTION

Whaling Out Of the Golden Gate

Science Has Taken the Danger and Some of the Thrill from Whaling, But the Glamour of the Chase Still Remains

By Franklin S. Clark

"THERE she is," cried the captain.

I was standing on the bridge by his side. We had been out of Drake's Bay two hours or more. It seemed hard to realize that in San Francisco, hardly more than 25 miles distant, clerks and salesladies were arranging merchandise for the day's business, and stenographers were fitting keys to office doors. We were, to be exact, 15 miles west-northwest of Point Reyes—about 20 miles north of the Golden Gate.

I looked searchingly in the direction the captain had indicated, and could make out nothing but tossing black water. The man at the wheel and the sailor who had been lounging on the fiddley amidships apparently had seen the whale, too. It seemed I was the only one who had not.

It was exciting, all right! Quite different, however, from the whaling days when New Bedford and Nantucket were the industry's leading ports. For one thing, the captain's pronunciation of "there" when he had cried out at sighting the whale certainly had no Yankee twang to it. Nor had he articulated the classic of whaling, "blows." Indeed, there was little savor of the old whaling industry, or of New England, either, about the captain. He was of German-American descent. Most of the crew were Norwegians.

Our craft, although of narrower beam, was of about the size and general appearance of an ocean-going tug. From her after cabin to her stern she was of especially shallow draft, to permit quick turns.

The *Hawk* carried a harpoon gun, mounted on the bow. In her midship hold were two bins, each containing 2,000 feet of neatly coiled two-inch rope. These were the whale lines, and they led up, through copper-lined hawse pipes, to the deck, and after several turns around the drum of a powerful winch, forward to the harpoon gun in the bow. One of the lines was spliced to the foregoing line of the harpoon itself, which was in the gun ready to shoot. In a corner of the midships hold was a heap of sharp-pointed bombs, to be screwed to the head of of the harpoon, forming a spear-like tip. These bombs were fitted with a slow fuse designed to detonate the bomb after the harpoon enters the whale.

"One bell and a jingle" sounded from below, the signal for dead slow. The whale had sounded. We were standing by, waiting for him to come to the surface to blow.

"Tell Nick," I heard the captain call to the sailor on the fiddley, almost in an offhand way. The skipper's countenance was quite unperturbed. To me, it seemed a breathless age before Nick, our gunner, emerged from the hatchway of the after cabin and sauntered to his gun.

Whirling Propeller Attracts Whale

Afterwards I learned that there really had been no need for hurry. The whale we had sighted was a finback. Such usually can be counted upon to stay down from ten to fifteen minutes. Ten minutes had passed and I was beginning to doubt if the captain had really seen a whale. Then came a tremendous, "whoof!"—close on our port quarter—as violent as an explosion. I was sitting on the forecastle hatch with my camera unlimbered ready to get a picture of Nick should he shoot. As I jumped and turned my head I half expected to find the *Hawk's* stern whisked away. Again the whale "blew"—this time not quite so violently, nor was the spout from the second "blow" as high as that of the first, which had appeared to rise about five or six feet. These "blows" sounded like a railway locomotive starting on wet tracks. The first was a mighty "whoof," as already described, as though it had been bottled up for a long time. The second was not quite so loud; and the third yet fainter, nothing more than a "whuff," such as a locomotive would make before settling down to business.

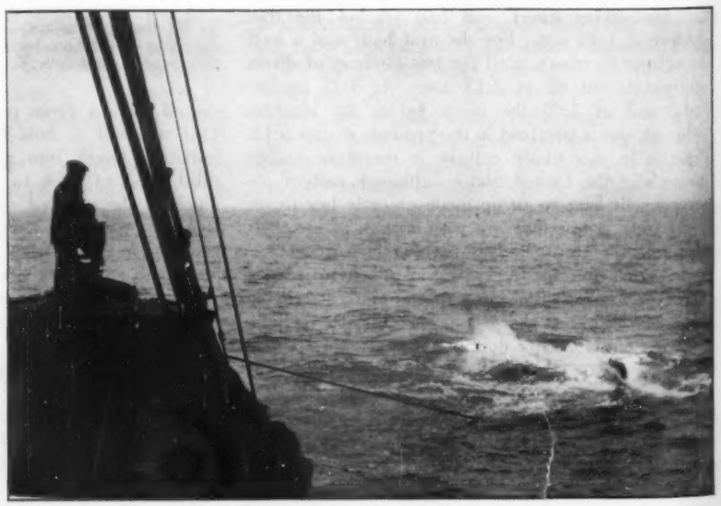
Four times, at intervals of about ten minutes, he came up, always astern, and on our port quarter. But always, after making one big "blow" and one or two moderate ones, and long before he came abreast of the bow where Nick could get a shot at him, he would dive and we would not see him again for another ten minutes. Each time we came hard around to port; as the whale seemed always to come up on that side. Nick, standing on the gunner's platform in the bow, gaze fixed on the water, indicated the course, by lifting now this hand, now that —motions somewhat like a brakeman's on a freight train.

The last time the whale came up to "blow," one of the crew said he could see him plainly under the water and that he seemed to have his eye fixed on the propeller. Later the captain informed me that this observation probably was correct. The finback is noted for its curiosity. Our propeller had attracted him just as a spoon lure does a fish. But after his fourth "whoof" in the immediate proximity of the propeller, his interest reverted to chasing shrimps, or whatever he had been doing when the *Hawk* sighted him. And he started away from the ship. Next time, his "blow" spouted up on the distant horizon! The finback's fifth "blow" might have been half-a-mile distant when the lookout reported it. And we were still more than 100 yards away when he sounded.

"Half speed," Nick directed, and we held to the same course. He was counting on the whale holding his course, too. And, sure enough, he did. When the whale came up to "blow" the sixth time, the *Hawk* was not far away. Cautiously we held to half speed, so as not to frighten him. Like a cat stalking a bird we crept up on him. For there is no catching

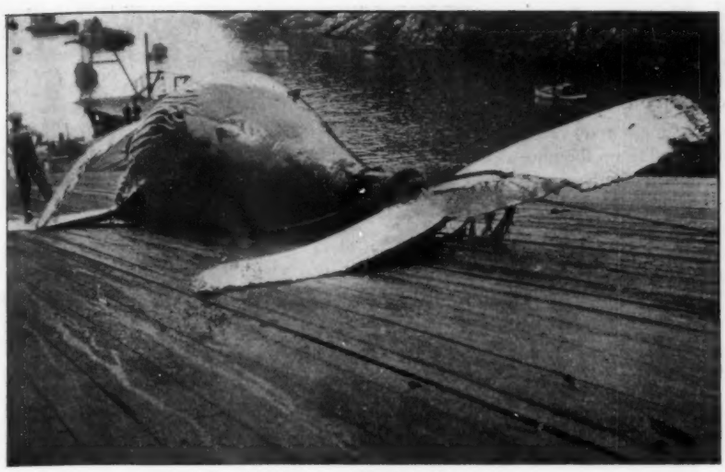
READY FOR THE SHOT

The barbed projectile, with its accompanying line, is still in the gun. The target of the gunner, the whale, is visible, being partly hidden by the port shrouds



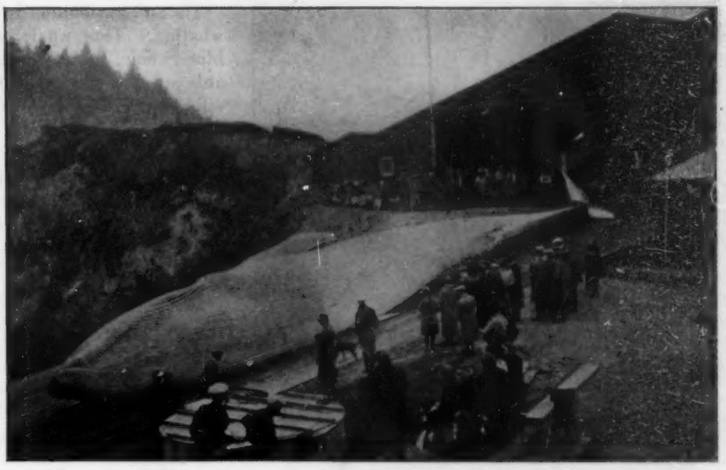
HIT IN A VITAL SPOT

The harpoon, having sped true to its mark, has found lodgement in the whale. The struggle is on. Whales will often battle for hours and tow the boat many miles



HAULING IN A HUMPBACK

With a strong cable just forward of its tail, and a winch working steadily, the captured whale slides slowly up the skidway, headed toward speedy disintegration



LOOKING OVER A SULPHUR-BOTTOM WHALE

A side view of one of the dead leviathans of the deep stretched out on the skidway at the Trinidad whaling station located on the northern coast of California

a whale once he is thoroughly alarmed. No matter what the speed of the boat, the whale can always escape by sounding.

Nick's air of nonchalance dropped away. I could see him come to his toes as he crouched over his gun, and it seemed to me he was making little dancing movements, like a boxer. Then Nick let him have it. A good 12 fathoms of line went out with the harpoon before the whale started running. The harpoon hit him just above one of his side flippers. It was a perfect shot. The whale bolted violently ahead. The *Hawk* backed water, as is always the practice after a hit, to prevent the line becoming fouled in the propeller in case the whale rushes toward the boat. But this whale held to the same course he had been following, leaving a blood-splotched wake behind him. He had not gone far, probably 150 yards or so, when his speed slackened. He came to a stop. Feebly his tail churned the water into foam, crimson-tinted with blood. But his tail strokes were too weak to propel his great body ahead. Slowly, as he lost his equilibrium, his head raised above the surface, like the bow of a sinking vessel, and he went down, tail first. Immediately the *Hawk's* winch began reeling him in.

Two sailors sprang to a block and tackle hung from the mainmast and started hoisting up on the taut whale line. This was to bring into service a series of heavy, coiled springs that lay along the *Hawk's* keel, and to which the block and tackle were connected by a steel cable running down into the hold. By taking some of the strain on the hoisted-up whale line, these springs serve the same purpose as does the springiness of a steel or bamboo fishing rod, in the playing of a big fish—taking up the slack.

There was plenty of need for it, for the whale clung to his spark of life stubbornly. The heavy rope at times almost sang with vibrations, like a taut bow string. As he snapped this way and that, little showers of spray were sent flying where the rope met the water's surface. The winch rattled busily away, and as a shadowy bulk, dimly discernible below the waves, came nearer, the vibrations ceased. The whale was dead.

Compressed Air Floats Whale

Presently the winch had pulled him alongside as near as practicable, and one of the crew, reaching out, jabbed into him the long sharpened nozzle of an air hose connected with a tank of compressed air. This air hose, through which the whale is inflated and rendered buoyant, with the stout line and the winch, are important items of modern whaling equipment, for it is not unknown for a whale to tear away from the harpoon and sink, and so be lost after he is killed. These finbacks and humpbacks and sulphur-bottoms—which are the varieties now chiefly hunted along the California coast, off Mexico and Alaska and in the Antarctic, where by far the largest number of them are taken—are not as buoyant as are the sperms and the right whales, the varieties chiefly sought in the early days of the industry.

The chase and capture had consumed more than two hours. It was noon by the time we had the whale alongside and secure, his tail hoisted up at the bow according to the accepted practice in towing whales.

Alive, when I had seen him come to the surface near the boat, the whale's back had appeared smooth, and in color, a glistening brownish black, not unlike the skin of a sea lion. As he became filled with air, however, he rolled squarely on his back, revealing a stomach of light gray, almost white, with deep longitudinal corrugations in it. He trailed back in the water for 60 feet alongside the *Hawk*.

Had it been a little earlier in the day, or had other whales been in sight, after inflating him, we might have marked him with one of the red flags which the *Hawk* carried for this purpose, leaving him to float while we went after more game. When whales are abundant, a boat can sometimes kill several, leave them in this manner, and then collect and tow them all in together to the shore station where they are rendered. The *Hawk* has at times brought in as many as six whales in one trip by resorting to this expedient. We were quite a distance from Drake's Bay, however, and towing the whale would make progress slow, so we started back without delay.

From this same base of operations, Drake's Bay, the *Hawk's* sister ship, the *Port Saunders*, also put out. Here, too, a third craft, the *Traveler*, waited every night for the other two boats, taking over any whales that they might have, to tow them 100 miles down the coast to the company's rendering plant at Moss Landing in Monterey Bay. The company has another whaling station at Trinidad in the northern part of the state.

The *Traveler*, although equipped with a gun and crow's nest, was in fact a converted tug boat. And it was said on the *Hawk*, which, with the *Port Saunders*, was built especially for whaling at Oslo, Norway, that it took her too long to turn around to be efficient at capturing whales. Nevertheless, a gun-

THE HARPOON AND BOMB

The bomb, held in the whaler's left hand, is fitted with a slow fuse which will detonate it when in the whale

A HUMPBACK ALONGSIDE

This whale has been successfully killed and hauled to the boat, with its tail in the air in approved style

"NICK" ON THE JOB

With finger on the trigger of the harpoon gun, he eagerly awaits the proper moment for releasing the huge dart

ner named Larsen had killed 175 whales from her bow in the season of 1918-19. The *Hawk* and the *Port Saunders* have records of more than 200 whales in one season.

Four days longer I lingered aboard, but as luck would have it, not another catch did we make. One day we spent at anchor because of a heavy fog outside. Another day it was too rough. The catches off the California coast have never been so good as they were in 1918. The tendency has been for the catch to become smaller each year. This does not necessarily mean, however, that the whales are becoming decimated. The more probable immediate cause, so the whaling men say, is that the whales in the vicinity of the shore stations are becoming increasingly wild from continued hunting of them. Or the smaller catches may be nothing more than the mysterious fluctuations such as occur in the catches of salmon and other fish.

Two humpbacks that we chased on the following day from ten o'clock in the morning until it was too dark to follow them, supplied a practical demonstration of how difficult it is to catch a whale if he really suspects something is up. These "crazy humps," as the crew called them, would sound, every time, well out of gun range. First they would come up on one side of the boat, then on the other. Sometimes they would even double in their course. Fat, covered with barnacles, the humpback is a slow swimmer, making not more than nine or ten knots at his best. But he can still escape any whale boat that can only navigate on the surface.

The sulphur-bottom is the noblest game of modern whaling. This whale, sometimes also called the blue whale, is the largest mammal in existence, although the sperm-whale is fatter and yields more oil. A week before I went out, the *Hawk* had captured a sulphur-bottom which measured 72 feet, absorbed two harpoons before "giving up the ghost," and towed the boat no less than 11 miles.

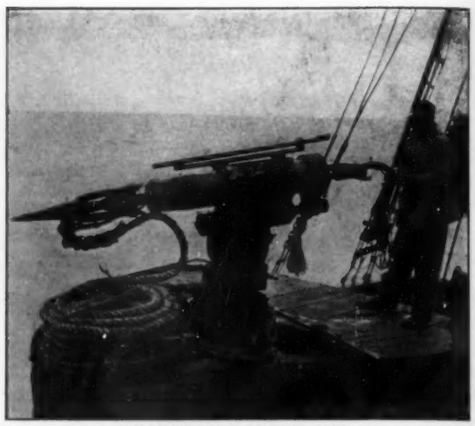
After leaving the *Hawk*, I visited the company's rendering plant at Moss Landing. The superintendent informed me that the finback which we had caught yielded about 40 barrels of oil, about a ton and a half of dried meat, which is used for chicken feed, and a ton of ground bone, used for fertilizer. Every part of the whale is utilized. But, while the meat and the bone are valuable as by-products, their worth is but a drop in the bucket as compared with the worth of the oil. Likewise, they represent only a fraction of the unrendered weight of the whale. The superintendent estimated that this finback would have tipped the beams at something like 60 tons. At the prevailing price of 56 cents a gallon, the value of the oil from our finback was 1,120 dollars, and the meat and bone 110 dollars more.

All whales, except the sperm, have baleen or whalebone plates in their mouths in place of teeth. However, the whalebone from the humpbacks, finbacks and sulphur-bottoms has no commercial value, except for fertilizer. Even the superior whalebone from the right whale and the bow head, which used to be hunted at some peril in the Arctic and Antarctic, to stiffen milady's corsets, is now somewha' of a drug on the market.

The Whaling Industry Today

Forty barrels is a fair yield of oil for whales such as are caught off the California coast. Our finback was in rather poor condition. The superintendent said that whales no bigger than the one we caught, often yield as high as 60 or 80 barrels. A fat humpback whale often yields 60 barrels. Sulphur-bottom whales frequently yield 100 barrels or more; some of the big ones taken off Alaska have produced as many as 200 or more barrels. Such yields are common with sperms, the fattest of whales. And speaking of sperms, the superintendent informed me that spermaceti, which in the history of whaling has sold for more than two dollars a gallon, now sells for only about 36 cents a gallon.

Most of the oil is sold to a large soap company. Some goes to a large petroleum product company, which uses it as a base for some of its lubricating oils.



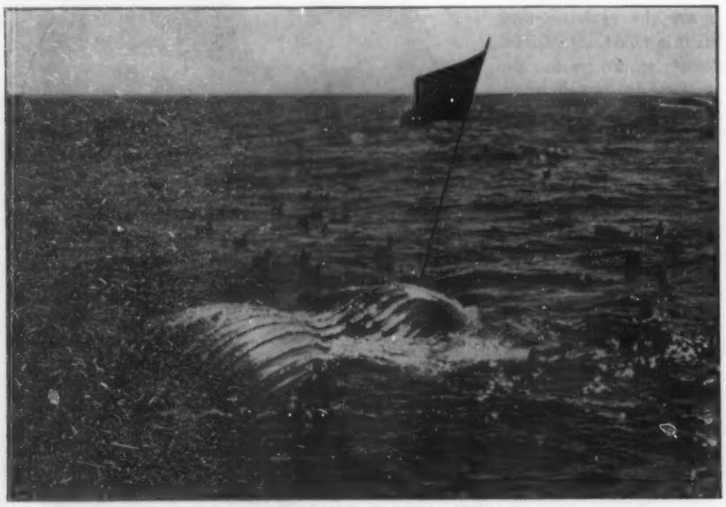
ANOTHER HARPOON GUN

This one, on the bow of the Hercules, *is similar in type to the gun used on the* Hawk, *described in this article*

Since its organization eight years ago, the company which operates the *Hawk* and the *Port Saunders* has taken over 2,000 whales of an average weight of 50 tons apiece, and rendered more than 60,000 barrels of whale-oil, besides obtaining several thousand tons of by-products. According to the *Norwegian Fisheries Gazette*, more than 750,000 barrels of whale-oil were extracted the world over last year. Boats like the *Hawk* and the *Port Saunders*, built in Norway, and operated largely by Norwegians from Sandefjord and Tonsberg, made most of this catch. Discovery of new and productive whaling fields in the Antarctic, off the British possessions of South Georgia and the South Shetland Islands, has been a boon to the whaling industry.

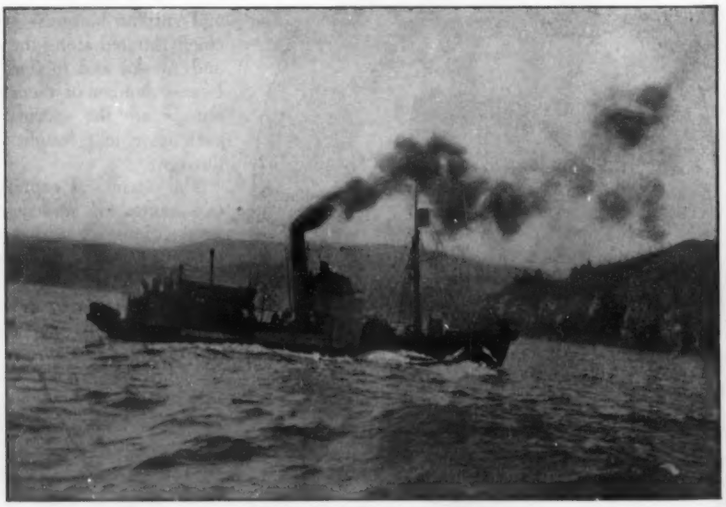
On the Pacific coast, whaling conducted by the present-day methods was started in 1905 by a Canadian whaling company from a station on Vancouver Island. In 1911 an American company opened a station at Grays Harbor, Washington, and the next year another station on the Aleutian Islands at Akutan. A Norwegian company operates a floating station off the coast of Mexico and off Southern California during part of the year.

The floating station, a ship of about twelve thousand tons or less, equipped so that the whale can be dragged aboard and rendered in the same manner as at a shore station, is the industry's latest device for the following of the whales wherever they are to be found. The whales are brought to the floating stations by auxiliary fleets of boats like the *Hawk* and the *Port Saunders*.



TO BE PICKED UP LATER

The whale has been harpooned, killed and blown up with compressed air. A flag serves as a marker to guide the crew of the boat that picks him up



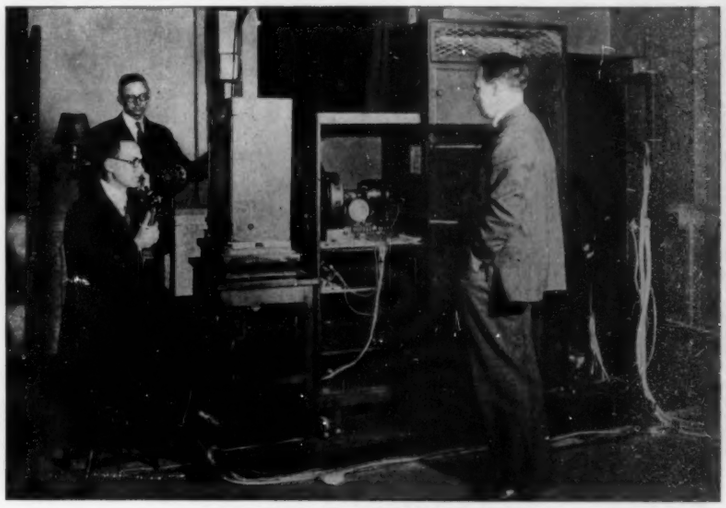
WITH A WHALE ALONGSIDE

The Port Saunders *returning after a successful hunt, with her valuable captive safely lashed to the side. Note the lines and tackle used for this purpose*

All photographs courtesy Bell Telephone Laboratories

DR. HERBERT E. IVES EXPLAINS THE SYSTEM

He holds the largest photo-electric cell ever manufactured. At his left is the receiving screen made up of 2,500 neon-gas bulbs, and described below



THE TRANSMITTING APPARATUS USED

R. C. Mathes is at the microphone, J. W. Horton is listening in and H. M. Stoller is superintending. All contributed importantly to the television system

Practical Television Demonstrated

One-way Transmission of Images of Moving Objects Marks Another Step Forward in the Telephone Art

By Louis S. Treadwell

EVER since science has made it possible for the human voice to be transmitted to a distance and faithfully reproduced, inventors have dreamed of doing the same thing with pictures or other objects. For several years it has been possible to transmit ordinary photographs by wire and radio, but the problem of sending motion pictures or images of actual moving objects has been found to be far more intricate. However, the solution has been found, and in the first week of April of this year, the results of intensive research and development work were shown by the Bell Telephone Laboratories.

Voice and Image Perfectly Synchronized

In the first demonstration, two-way telephonic communication was maintained between New York and Washington, D. C., and the images of the various persons at Washington were sent by the new process to the New York terminal of the wires. Secretary Hoover, in Washington, opened the demonstration, and his voice synchronized perfectly with the illuminated image of himself that was cast on a screen in New York. All facial characteristics, the play of emotions and in fact every detail at the Washington terminal were plainly seen by the watchers in New York.

Three telephone lines to Washington were used—one for transmitting the voice, one for transmitting the television current, and the third for the synchronization of the electric driving-motors at each end of the lines. The three lines operated at considerably different energies.

A brief description of this seemingly uncanny performance necessarily can only outline the principal mechanical features. It cannot include the details of the multiplicity of controls, amplifiers and regulators that are most essential and which, to the uninitiated, would seem like a hopeless maze of apparatus.

The main operating unit at the transmitting end is a light of high intensity, enclosed in a light-proof compartment. Rays from this light are emitted through 50 holes in a disk. These are spirally arranged so that one complete revolution of the disk will completely cover with spots a screen or object upon which the rays are focused. As the disk is revolved at the rate of 15 times each second, it will be evident that the screen surface will be completely over-run by spot flashes 15 times per second. On the receiving end is a duplication of this apparatus; both the sending and receiving motors are synchronized, or timed, by an ingenious mechanism so that they run at speeds which are uniform within one hundred-thousandths of a second. The time of transmission of each separate image is less than one fifteenth of a second.

If, now, on the sending end, the spots of light fall upon an object which has variation of color, such as the human face, light will be reflected from the object in varying intensities, according to the degree of lightness or darkness of the minute place on the object upon which each spot of light falls. When this is accomplished 15 times each second, it will be apparent that the entire object has reflected light spots of varying intensity with such rapidity as to excel by a wide margin the rapidity of sight, so that the optical effect, due to retention of vision, is one of continuity. In reality, the spots of light on the object seem to be a continuous flood—only a shimmering effect is noted.

RECEIVING BY RADIO AND TELEPHONE

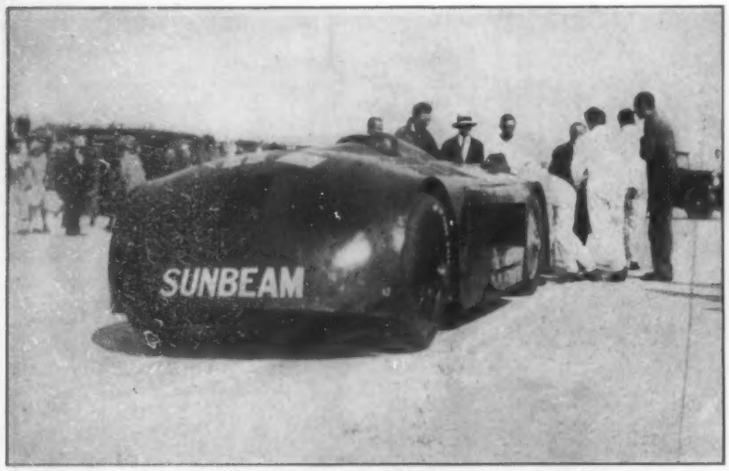
Dr. Frank Gray, with his hand on the loudspeaker, was largely responsible for the receiving system used

Television Analagous to Eyesight

As the spots of light fall on the object, the varying degrees of reflected light are picked up by three of the largest photo-electric cells that have ever been built. These impulses, so picked up, are amplified and intensified five thousand billion times and sent over a separate wire to the receiving end. Here is a receiving screen made of a mozaic of small neon-gas bulbs, each bulb connected by a wire to a distributor which feeds to it just the amount of impulse that has been reflected from the corresponding spot on the object at the other end. These bulbs, therefore, will each glow with an intensity varying in degree according to the lightness or darkness of the same spot on the object and this, occurring 15 times a second, gives an optical impression of continuous reproduction.

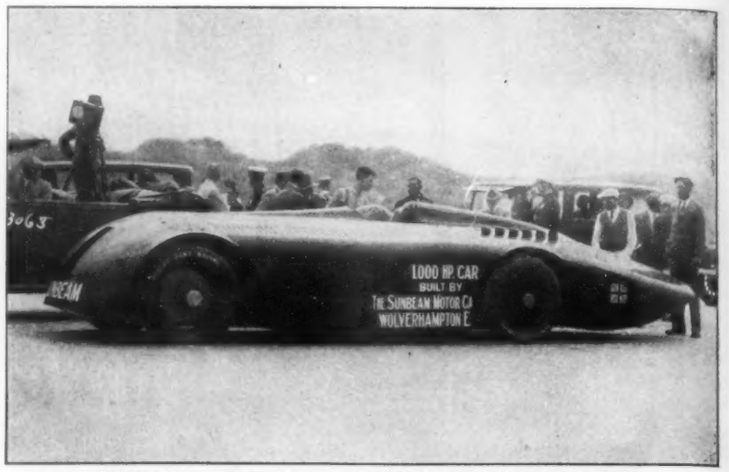
The analogy of television with the function of sight of the eye is exceedingly close. The surface of the retina is composed of infinitesimal spots which are individually connected and run back to the optic nerve. So the surface of the receiving screen is composed of 2,500 individual neon-gas light squares, each square connected by a wire that runs back to the distributor which picks out and transmits to that wire the impulse which the original image has caused to be sent.

The present demonstration is without question a marvelous scientific accomplishment. But the intricate and costly units involved, the organization and multiplication of individual controls at each step of the operation, together with the necessity of tremendous resources of expert men, money and materials, renders entirely imaginative any prediction as to the commercial possibilities which this demonstration portends.



THE CAR WHICH AVERAGED 203.79 MILES PER HOUR

Note the blunt forward end, the straight vertical, parallel sides, and the recessed wheels, which the wind-tunnel tests proved best



SIDE VIEW SHOWING THE UNUSUAL STREAMLINE FORM

Length of car is 23 feet, 6 inches; weight, four American tons. A 500-horsepower motor is in front; another is behind the driver

A Two Hundred Mile-Per-Hour Car

How the Physicist, the Chemist and Wind-tunnel Tests Collaborated in Producing the Car Which Made 203.79 Miles Per Hour On Daytona Beach

By J. Bernard Walker

THE feat of Major H. O. D. Segrave in driving a car at a maximum speed of 207.01 and an average speed of 203.79 miles per hour, was the culmination of one of the most interesting aerodynamic and mechanical investigations ever carried out. The trial, be it clearly understood, was no mere spectacular stunt. Back of that flying wonder, as it swept over Daytona Beach, lay many months of technical investigation and costly laboratory experiment, which were translated into the unique, streamlined monster that went roaring down the course at a speed of some 310 feet per second.

Both the Sunbeam Motor Car Company and Mr. Louis Coatalen, the designer, realizing that, with the widening and general improvement of automobile thoroughfares, there was bound to be a steady increase in speed, particularly over the special, inter-city, motor roads of the future, decided to determine definitely certain questions of proper streamline form for high speeds, the best type of tires, and the utmost possibilities of transmitting high horsepower through clutch and shafting to the driving axle. As a result of this very costly experiment, and of Major Segrave's successful handling of the car at the enormous speed achieved, the automobile world is put in possession of certain well-proved data which will be of great value in the future development of the motor car.

New Streamlining Minimizes Air Resistance

It was realized that the outstanding problem in this car, as in the high-speed airplane, was to cut down air resistance to the minimum, and this of course necessitated some elaborate testing in the wind-tunnel. Consequently, several firms, British and Continental, including Vickers Limited, were given the problem of designing a car body which would secure the highest speed. Among the car bodies thus developed, the fastest guaranteed speed was that of a Vickers design, in which the longitudinal section of the machine resembled quite closely the deep-section type of airplane wing which has become so common. This firm predicted a speed of 236 miles per hour for a given horsepower.

By the way, just here, in order to get the facts in their proper sequence, it should be explained that the pointed, projectile-shaped, front end, which is ordinarily adopted to give high speed, was rejected early in the investigation; for it was found that the air was thrown to the sides, impinged on the forward pair of wheels and set up a total amount of head resistance that was prohibitive. Hence, it was determined to make the car body with flat, vertical, parallel sides from bow to stern, and cause the displaced air to pass over, rather than over and around, the machine. It is this principle of design that accounts for the striking and very radical streamlining of the Sunbeam car.

Returning to the Vickers-designed car body, which promised 236 miles per hour, it was found that there was a downward air pressure approaching 1,000 pounds upon the forward end of the car, and that there was an even larger upward or suctional pressure on the after part of the car, with the result that the ultimate load would have been carried on the steering wheels, and the rear driving axle would have been in danger of lifting clear of the ground.

MAJOR H. O. D. SEGRAVE

The facts recorded in this story and the personal impressions of the driver were obtained during an interview with the Major and his technical staff

Then followed a series of interesting wind-tunnel experiments to correct this, and the difficulty was solved by curving the forward under part of the car upwardly, as shown in the photographs, and by giving a longer and finer upward curve to the underbody at the rear of the car. These modifications led to the form that was finally adopted, in which, when the car is running at 200 miles per hour and over, there is a downward pressure of 750 pounds and an upward pressure of 350 pounds, at the forward end, leaving a resultant downward pressure on the forward wheels of 400 pounds. The streamlining of the after portion served to give a downward pull or pressure of 600 pounds to modify the upward or suctional pull of 800 pounds, leaving an upward pull of 200 pounds. This was found to give good fore-and-aft stability and the desired steering control of the machine.

Three and a Half Miles a Minute!

As anyone can see for himself, and particularly after looking at our longitudinal drawing of the machine, this car is unlike anything hitherto produced. Its foundation consists of a massive, steel-channel chassis frame, at each end of which is mounted a 500-horsepower, 12-cylinder, Sunbeam-Coatalen engine. The 12 cylinders are in two banks set at an angle of 60 degrees. Each cylinder carries four valves operated by overhead cam shafts. The 500 horsepower is developed at 2,250 revolutions per minute; although each engine can be run at a somewhat higher speed than this, with a corresponding increase of power.

Very interesting are the gearing and transmission. The two engines are placed on the longitudinal axis of the machine, and at the rear end of the forward engine is a plate clutch, containing an additional dog-clutch, and from this a shaft is coupled up to the rear engine. The two engines are started simultaneously by compressed air. Then, a further move-

ment of the clutch lever engages the dog-clutch and solidly locks up the drive between the two engines. The drive is then taken through a multiple increasing gear of about five to two to a driven shaft, on the end of which is a multi-plate main clutch. This connects with a gear box with central control, having three forward clutches and reverse, the ratios being:

3rd	2nd	1st	Reverse
1.017 to 1	1.56 to 1	2.968 to 1	2.6125 to 1

From the gear box the drive is taken through a bevel-type reduction gear to a cross shaft, on which are mounted the sprockets which convey the final drive to the road wheels by means of roller chains. At the normal maximum engine speed the car makes 67.0 miles per hour on first gear, 129 miles per hour on second gear, and 209 miles per hour on third. The maximum speed achieved on the run, using ethyl gasoline, was, as mentioned, 207.01 miles per hour, when the machine was covering 3.45 miles in one minute, and 109 yards in one second.

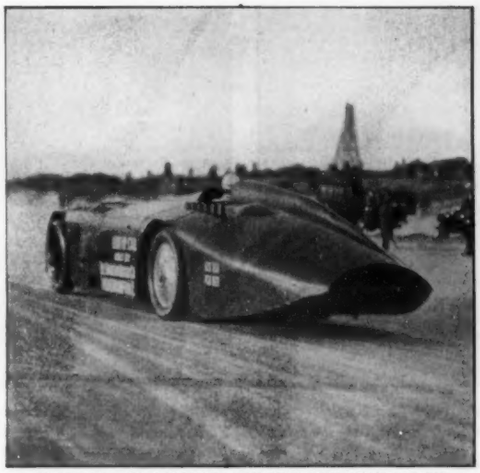
The following calculated air resistance at speeds of over 180 miles per hour are of deep interest. This amounts, at 180 miles per hour, to 740 pounds; at 190 miles per hour, to 830 pounds; at 200 miles per hour, to 920 pounds; and at 210 miles per hour the actual wind resistance is 1,020 pounds, or about half a ton. Interesting, also, is the statement that at 200 miles per hour practically 500 horsepower of the total horsepower developed, is required to overcome the air resistance alone.

Tires Had No Tread

The body of the machine is built in sections of sheet aluminum, securely fastened on a framework of angle iron. As a measure of protection for the driver, strong steel hoops are fitted immediately in front of and behind the driving seat. The bottom of the car throughout its whole length is covered by a steel plate, which is attached to the bottom flange of the side frame members. To guard against danger in the event of a tire tread or a chain flying off at high speed, armor plates are fitted around the tires and driving chains, and these, as will be noted from the photographs, are recessed within the body of the machine, thus eliminating the enormous air resistance which they would confront were they standing clear of the body, as in the case of the ordinary racing machine.

The car is a massive affair, with a total weight of about 3 tons, 16 hundred-weight, or 4 American tons, and an over-all length of 23 feet, 6 inches.

Another serious problem confronting the designers, which rivaled in importance that of securing the best streamlining for such high speed, was that



REAR VIEW OF THE RECORD-BREAKING CAR

Note again the flat parallel sides, and the long, easy streamlining as compared with the blunt bow

of building tires capable of carrying, as each of them did, an ultimate load of about 2,000 pounds, and standing up under the drive of the high-powered engines and the shocks due to the inequalities of the ground. These tires, which measure 6¾ inches by 36 inches, in addition to the mere carrying of the load, have to endure the constant hammering and drag upon the track surface, and the least strenuous of their duties is to carry at the same time, the constant stress of an inflation pressure of about 60 pounds per square inch. At 200 miles per hour the tire makes 1,800 revolutions per minute or 30 per second. Hence, every inch of its circumference is heavily hammered, between the rim and the load, thirty times during a second. You can make a slab of iron red hot by continual hammering; so, also, does a racing tire rapidly get hot under its strenuous service. Rubber is destroyed by a temperature of 200 degrees, Centigrade, when it loses its elasticity and strength. When a racing tire approaches this temperature, the rubber tread can no longer stick to the cotton foundation—it strips off, generally with a loud report. These tires, however, carried no tread. Moreover, when the car was making over 200 miles per hour there was a force of four tons tending to burst the tire, just as a fly wheel bursts when it exceeds a certain speed. So great is the centrifugal force that the tires become oval in cross section, being reduced in width by 1½ inches. Another interesting fact is that, so great is this centrifugal force, that should a tire become deflated, it would still maintain its form and carry the load, the centrifugal force being sufficient to balance the load pressure tending to flatten the tire.

And just here let it be understood that these records, being made under the auspices of the Contest Board of the American Automobile Association, are absolutely reliable. Electrical timing by means of wires laid across the track, connected to a chronometer timing clock, were used to determine the time to one-thousandths of a second. To eliminate any favorable influence of the wind, the runs were made both north and south over the same course. There was an 18-mile wind blowing diagonally across the course at an angle of about 45 degrees. Major Segrave found that the machine was remarkably sensitive to this wind effect, the gusts tending to throw him laterally off his course, and, so great was the speed, that it took half a mile or more to bring the machine back on to the line of the markers.

The Official Speed Record

Trip	*Distance*	*Net Time*	*M.P.H.*	*K.P.H.*
North	1 Kilo	11.20	199.7259	321.4285
	1 Mile	17.94	200.6688	322.9364
	5 Kilo	56.47	198.0637	318.7533
South	1 Kilo	10.84	206.3590	332.1033
	1 Mile	17.39	207.0155	333.1500
	5 Kilo	53.90	207.5076	333.9517
Mean average by averaging times.	1 Kilo	11.02	202.9883	326.6787
	1 Mile	17.665	203.7928	327.9637
	5 Kilo	55.185	202.6757	326.1755

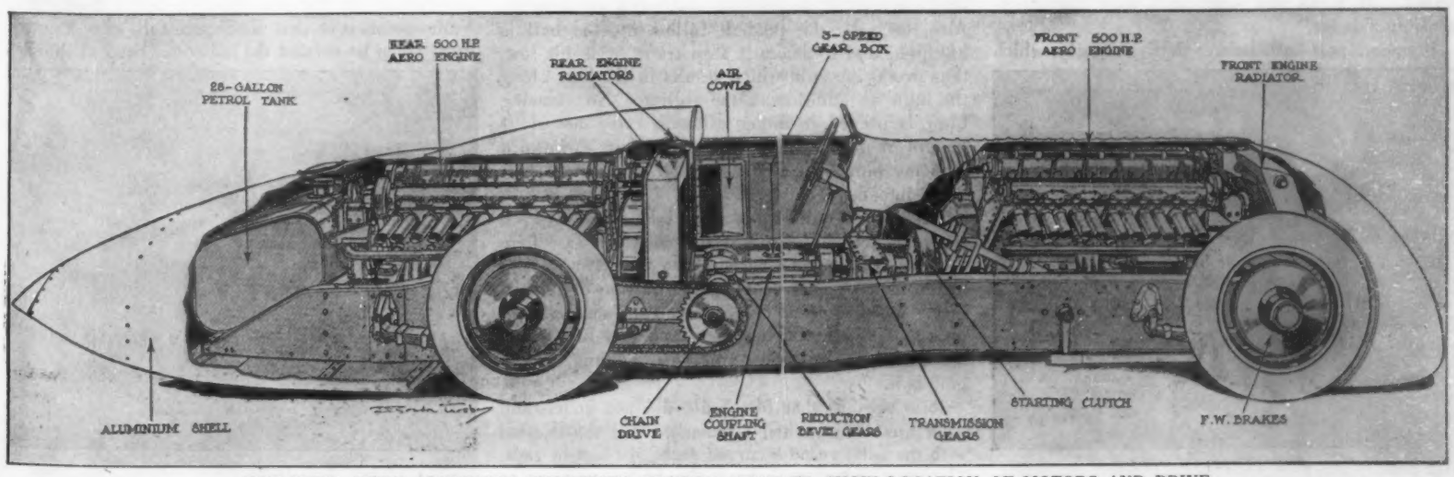
Approved:
Val Haresnape,
Secretary, Contest Board.

Judges:
T. E. Myers,
Gar Wood.

Timer:
Odis Porter.

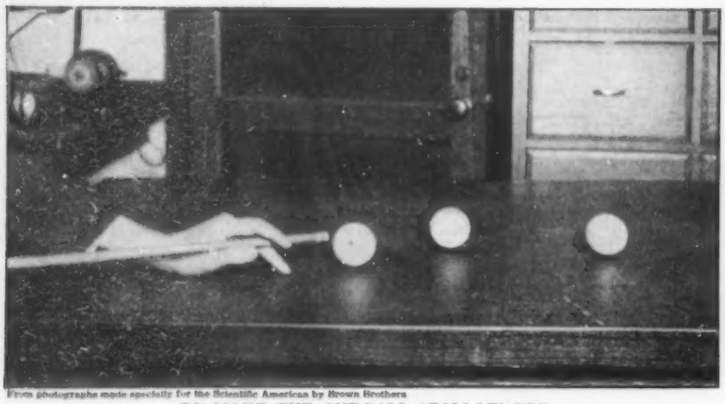
Compare the speed achieved with that of falling bodies. To attain 200 miles per hour, a car would have to fall for a quarter of a mile, and a car falling 1,000 feet over a precipice would strike the ground with a speed of only 160 miles per hour. A golf ball is driven 200 yards in five seconds. Major Segrave's car would take less than two seconds.

That the task was a strenuous one will be understood when we say that the pressure upon his forehead alone, as he watched the course, was at the rate of 112 pounds per square foot. Moreover, in the few seconds which it took for him to remove his eyes from the course to his speedometer and back to the course, the machine covered nearly 1,000 feet of distance.



SIDE VIEW, WITH ALUMINUM SHEATHING BROKEN AWAY TO SHOW LOCATION OF MOTORS AND DRIVE

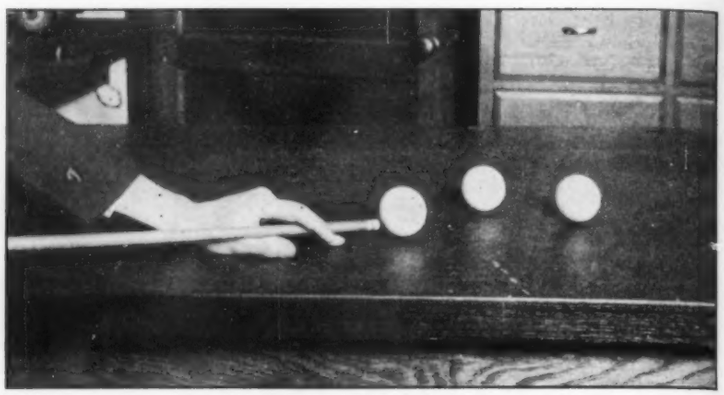
There is a 500-horsepower aero engine forward and another aft, with a coupling shaft between, firmly locking them together. Driver, seated at center, is protected in the event of overturn, by strong steel hoops, encircling his position. Cooling air for the motor enters through bow and through side cowls



From photographs made specially for the Scientific American by Brown Brothers

TO MAKE THE CUE-BALL "FOLLOW UP"

In playing billiards, the art of "putting English" on the ball consists of hitting the ball high or low, according to the effect desired. When the ball is hit high as shown here, it will continue to roll after striking another ball



TO MAKE THE CUE-BALL STOP SHORT

This is another form of "putting English" on the cue-ball. The cue is held low and strikes the cue-ball a direct blow at a point lower than the center of the ball. This is done to impart to the cue-ball the desired backspin

Physicist and Golf Expert Still Disagree

On These Pages, Prof. Sheldon and P. A. Vaile Present Further Arguments On the Physics of Golf Strokes and the Flight of Balls

By H. H. Sheldon

THE two articles on golf which have appeared in this magazine—one by myself in August, and one by P. A. Vaile in December of last year—impel me to undertake a third discussion of this fascinating subject. I cannot let the matter rest while Sir Isaac Newton stands charged by Mr. Vaile with "slicing one into the rough," especially as I feel sure that in the point at issue he kept, as was his habit, in the fairway.

Rising to the defense of Newton, I maintain that striking the ball with an oblique club or bat does not push the ball to one side, as Mr. Vaile suggests, but does exactly what Newton says, namely, imparts spin. There is no difference whatever between hitting a ball with an oblique instrument, and hitting a ball with an ordinary instrument, using an oblique blow. The two results are identical.

The question which I raised in my article: "The Physics of Golf Balls," as to whether the use of a smooth ball would largely avoid the deviation due to spin cannot be disposed of so briefly. I suggested the use of a smooth ball. Mr. Vaile offers two reasons against it. His first is: "A smooth golf ball is useless for golf because its flight is very erratic. It ducks and soars in a most uncomprehensible manner."

If smooth golf balls behave thus peculiarly, which I regard as doubtful, it can only be due to the lack of stabilizing effect caused by air friction, usually resulting from markings. All effects are due directly or indirectly to this friction (Magnus effects). Thus, any slight lack of symmetry in the ball itself, if smooth, would produce a greatly magnified deviation during flight.

Mr. Vaile's second point in this connection is: "The effective spin of a golf ball is affected very little by the nature of the marking of the cover. It is produced, practically entirely, by the nature of the blow."

In my article, nothing was said about the nature of the blow, which as everyone knows is the major thing in the determination of flight. It dealt only with variations due to the ball itself after flight had begun. Certainly no spin which was not there when it began would appear later in its flight, but rather the spin would tend to diminish during flight. Mr. Vaile also says, "It is fairly obvious that hitting a ball slightly below its center will not of itself produce underspin or backspin, as the golfers call it."

Perhaps golfers do not know this but all billiard players do, for the so-called "English" on a billiard ball is caused by a direct hit and not a glancing blow—the chalk prohibiting that—and yet it spins. Also, to make the cue-ball follow up, the ball is hit high, and to make it stop short, it is hit low, thus producing spin which results in slipping along the table in addition to the rolling. No glancing blow is needed in either of these cases, nor do I believe it is necessary in golf. Any downward glancing blow will obviously tend to drive the ball down into the ground.

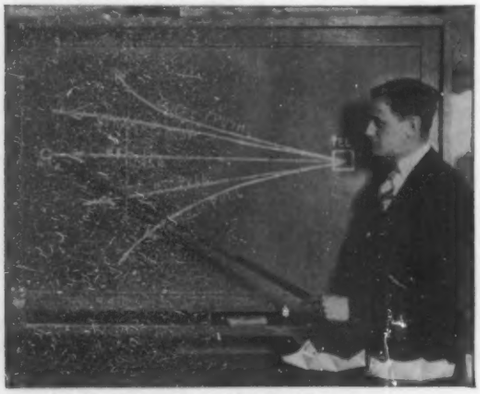
When Mr. Vaile speaks of tennis, however, a brushing across the ball is necessary, because here the ball will flatten sufficiently so that it is in contact with the racket over a large portion of its surface. When someone repeats Mr. Vaile's experiment on a tennis ball, which he performed by blackening the racket, a different result will be found for a golf ball.

It is obvious that Mr. Vaile did not understand what was meant, when I remarked that the friction with the ball caused a curved path. In fact he says, "I cannot indeed see why it should be supposed to influence spin to any great degree, for the marking is of the same nature all over the ball, and therefore, apart from adventitious air currents, one side should provide as much resistance as the other."

This statement had to do entirely with the "Magnus effect," which he later describes, and calls my attention to, assuming apparently that it was an effect with which I was entirely unfamiliar. He may not feel that this amounts to very much, but if he will take measurements as suggested in my article and as pictured in Figure 4 of that article, he will find a difference in pressure for different markings.

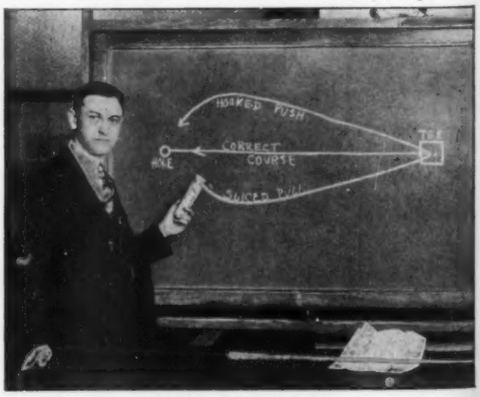
He says further, "I maintain and have fully explained in my book, 'Swerve or the Flight of the Ball,' that spin is mainly, in fact almost entirely, produced mechanically by the nature of the blow." I maintain likewise that normally, the club does not follow the ball during its entire flight (!) hitting it from one side to the other causing it to curve, and that whatever the ball may do after it has left the tee, must be the result of the action of the air on the ball itself.

Mr. Vaile apparently is of the opinion that he has made a great discovery by finding that the Magnus effect influences the golf ball, but fails to discover further that that is exactly what J. J. Thomson was measuring, when he measured the difference in pressure on the two sides of a golf ball. Mr. Vaile points out that Thomson fell into a grave error when he rotated the ball on a vertical spindle.



A FEW POSSIBLE SHOTS

The drawings show some of the shots in golf, with the names assigned to them by one of Professor Sheldon's correspondents. Are these correct?



CURVING THE BALL

By properly striking the ball, a curved flight can be obtained. Here again, the names shown in the diagram were furnished by the correspondent

He says, "He is assuming that the action of rotation in the pull and slice are vertical, whereas they are not." It does not seem to have occurred to Mr. Vaile that this spindle might be put at any desired angle without in any way altering the results, providing of course the pressures are measured on a line at right angles to the axis.

Since writing my previous article, I have given more attention to golf than formerly, and therefore take this opportunity to make some corrections and additions on my first contribution to the subject.

I have to thank one of my correspondents for putting me right on some of the terms in golf. In my first article, I have used "slice" and "pull" as opposites, whereas I should have used "slice" or "hook," "push" or "pull." There may of course be combinations of these such as a "hooked push," et cetera. These a correspondent has pictured, and I take the privilege of illustrating them in these columns.

I have also had my attention called to a serious error in Figure 3-B in my article in the August issue of the Scientific American, in which the dotted arrow should obviously (from the discussion) have been below and not above the solid arrow. Also the definition of the coefficient of restitution should have read in part, "the height to which the ball rebounds, divided by the height from which it fell"—just the reverse of what was stated.

This correspondent also suggests other measurements which would undoubtedly throw a great deal of light on the subject which mainly interests Mr. Vaile, namely, the nature of the blow. He wants to know just how much the ball is compressed and bulged by the impact of a 200-yard drive, the length of time it is in contact with the club head, and also the initial velocity; all these are measurable and it is hoped that someone will take the trouble to make the determination.

Mr. P. A. Vaile's Rejoinder

PROFESSOR SHELDON in "defense of Newton" says: "I maintain that striking the ball with an oblique club or bat does not push the ball to one side, as Mr. Vaile suggests, but does exactly what Newton says, namely, imparts spin. There is no difference whatever between hitting a ball with an oblique instrument, and hitting a ball with an ordinary instrument using an oblique blow. The two results are identical."

So far as regards the oblique face in hitting I must leave Professor Sheldon to the tender mercies of the golfers. They *know* that they land in the rough when they do this and "Golf," by Bob MacDonald, the outstanding authority of the world on playing and teaching the game, quite settles the point for anyone who thinks it needs settling.

The difference in the nature of the blows is that in the cut strokes the ball "eases" onto the club from what is almost a point, comes to the period of full compression in the middle of its run or roll and *eases off* on the other side, whereas in practical golf there is next to nothing of this in a blow with the oblique face. In all cut strokes, in tennis or golf, the period of adhesion is longer than in the other more direct blow.

To put it possibly more clearly, the ball and the club travel together in contact for a greater period and thus allow for more accurate aiming. It is a singular fact that all the greatest and most scientific strokes in both tennis and golf are *glancing* blows and *not direct hits.*

In the straight blow with an oblique face, the ball, during the period of adhesion, is practically in the line of flight all the time. In all cut blows it is being carried at an angle to the initial line of flight while in contact with the face of the club being used.

THE SLICE

This photo-diagram is from "Golf," by Bob MacDonald, famous player and teacher. It shows the correct position for playing the slice by a glancing inward blow *across the ball. Note the difference in the position of the feet in this and the opposite illustration and the position of the club with relation to the line of flight*

The vagaries of the smooth ball are in the history of golf. They are beyond argument. Even the tradesmen can tell Professor Sheldon that. My explanation of its eccentricities, in the Scientific American, ascribed it "to the lack of stabilizing effect," as Professor Sheldon says. It could scarcely be otherwise, but I explain *the details* of this "lack of stabilizing effect," which is the important point.

The analogy between golf balls flying in the air and billiard balls running on a solid, so frequently attempted, is imperfect. A blow *on a definite point* off center sideways and below the center of mass, as with a cue, is not practicable in golf as in billiards, nor, in golf, is the blow, in the vast majority of cases, in a horizontal line as in billiards. It is much too often upwards.

Speaking of backspin, or drag, in billiards, Professor Sheldon says the ball is hit low; "thus producing spin which results in slipping along the table in addition to rolling."

The merest tyro at billiards knows that his ball cannot have backspin and be slipping *and* rolling at the same time. The roll cannot start until the friction has overcome the backspin; and there is not any forward "spin" on a billiard ball hit as shown on the opposite page. It is mere *running* as in a car wheel. This is a common error in golf writing wherein topspin is attributed to the putt.

Ball Runs *Up* the Club Face

Professor Sheldon says: "No glancing blow is needed in either of these cases, nor do I believe it is necessary in golf."

Well, for my sins, and many other people's crimes, I happen to be the author of the only book on the flight of the ball and also of three major works on golf and I *know* that the glancing blow is necessary. All authorities are agreed on this point. We do not consider it arguable.

"Any downward glancing blow will obviously tend to drive the ball down into the ground," says Professor Sheldon, but this is *not obvious* to those that know, for the ball instantly starts to run *up* the face of the club. It is the upward glancing blow, in both tennis and golf that makes the ball "dive."

Professor Sheldon's remarks about Professor Thomson's error mean nothing, for he says, "providing, of course, the pressures are measured on a line at right angles to the axis." This is what Thomson is doing and what nobody conversant with the ballistics of golf would do.

I note that Professor Sheldon says: "Since writing my previous article, I have given more attention to golf than formerly," and he proceeds to correct some of his mistakes. He is not, however, incorrect in using "slice" and "pull" as opposites. They are, for all practical purposes, recognized as being so by all the leading authorities, in fact by all golfers.

I am afraid that Professor Sheldon's informants are not well posted in modern golf nomenclature.

"A sliced push" is an impossibility. "A straight push" could be straight only as regards its plane of flight, for it swerves upwardly, due to its backspin. "A straight pull" does not exist. "A hooked pull" is pleonasm of the order of "a swerving outcurve."

"A hooked push" is an absurdity, but the gem of all is the "sliced pull." Until I learn what a square circle or a liquid solid is I cannot even express an opinion about it, although, using the vernacular, it is quite possible "to pull a slice," and it is said that Joe Kirkwood, the trick-shot player can do it.

"Hook" is the ancient term for the modern "pull" and was, I think, a better term.

I hope that Professor Sheldon will continue his interesting efforts to instruct golfers for they are not "long on science" generally speaking.

I am not heralding myself as a discoverer, but, so far as I know, I *am* the first to show the Magnus effect in ballistics.

In conclusion I should like to direct the attention of Professors Sheldon and Thomson to a point raised by me subsequent to the publication of my book on "Swerve or the Flight of the Ball" (1905), and that is the possibility of one side of the ball being heavier than the other in backspin, where the rear part of the ball is hitting down *with* gravitation and the forward part hitting up *against* gravitation. The same element, of course, enters into the drift of a bullet of which I have never seen what was, to me, a completely satisfactory explanation, and also into the practicability of swerve in vacuum raised by me in my book.

THE PULL

Photo-diagram of Bob MacDonald, showing correct position for a glancing outward blow *across the ball, which is necessary to play a pull properly. The white lines on the ground serve to show the reader the exact relationship of the placement of the feet and aid comparison with the opposite illustration where the slice is demonstrated*

All photographs by Herbert Photos, Inc.

PORTABLE AMATEUR STATION

The owner of 2EB has installed a short-wave outfit in an automobile so that he can conduct tests on reception at various points from the five-meter transmitter at his home

TUNING A FIVE-METER TRANSMITTER

Boyd Phelps, owner of 2EB, holding the five-meter wave-meter that measures the wavelength which the station is emitting. This is one of the standards mentioned in the text

Radio's New Kingdom

Amateurs Now Talk on the Five-meter Waveband

By Orrin E. Dunlap, Jr.

DOWN, down, down go the amateur radio experimenters, delving into the short-wave field, triumphing as they go by spanning world-wide distances with simple apparatus radiating less power than consumed by an ordinary incandescent lamp. The latest achievement is two-way communication established on the five-meter wave across a distance of 30 miles by Boyd Phelps, owner and operator of station 2EB, at Jamaica, Long Island, New York, who talked with E. S. Strout, owner of station 2NZ at Teaneck, New Jersey.

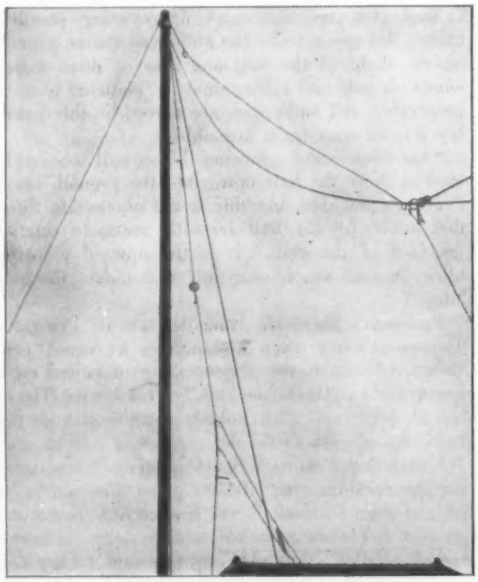
They experimented for three years before they were able to do the trick. During that time their most astounding discovery was that the shorter the wave, the less complicated is the apparatus needed for transmission. They found simplicity to be the keynote of success so they even discarded the usual tuning coils and substituted short lengths of copper tubing. Since the initial test, verification of reception of the five-meter signals has been received from amateurs in Seattle, Washington; Hartford, Connecticut; Pierce City, Missouri, and Lawrence, Kansas. However, up to the present time no two-way, five-meter communication has been reported other than that from Jamaica to Teaneck. Strout has since moved to Chicago and the two experimenters are now striving to link the mid-west with Long Island via the five-meter wave route through space.

Plenty of Room Below Five Meters

The extremely short waves are very "tricky." Minute adjustments, coupled with considerable patience, are needed for the operation of the delicate instruments both at the transmitter and at the receiver, according to the experimenters. They explain the importance of the field with the calculation that if all the radio stations in the world were confined between the waves of four and five meters there would still remain room for more! This includes all the amateur stations, broadcast stations, ship stations, transatlantic commercial stations and others of different classifications.

"In order to understand this clearly it is necessary to explain that the number of kilocycles per meter increases very rapidly in the lower scale of wavelengths," said Mr. Strout. "There are between 55,000,000 and 65,000,000 cycles per second in the 4.69 to 5.35 meter band, while in the entire broadcast band there are only 500,000 cycles. Therefore, all the North American broadcasting stations could be operated between the wavelengths of five meters and 5.1 meters with much less interference than now exists in the chaotic state of broadcasting. In fact, tuning a five-meter receiver over the band now open for experimentation (4.69 to 5.35 meters) is similar to tuning a receiver that covers the wavelengths of from 20 to 30,000 meters. Even when using dials having a high-ratio vernier and rotating them very slowly, the beat notes are often passed by as an individual click, or nothing may be heard if at that instant the transmitting operator happens to have his key up, as for example, between dots.

"Because of these facts, in order to facilitate first contact—that is to find the station or tune it in—it has been necessary to use power that may seem excessive to some. This made the signals easier to find, and it also facilitated reception greatly by broadening the transmitter's wave."



A SHORT-WAVE AERIAL

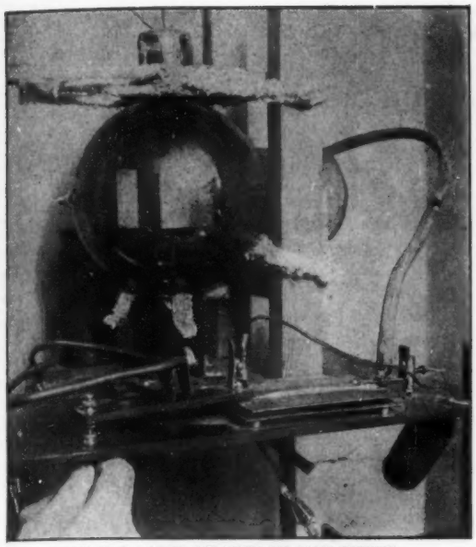
The vertical wire used at 2EB. Note the meter for measuring the antenna current. It is read with field glasses

The transmitter at 2EB uses a special tube, which permits a power input up to one kilowatt at five meters without overheating or causing the wave to become unsteady. 2NZ uses a 204-A tube with an input of about 600 watts. This amount of power is not necessary for bridging the gap between the two stations, but, as stated before, tends to make for greater ease in locating the beat note by the receiving operator. Locating the wave of the distant station is the most difficult job; once this has been done, the transmitting power can be greatly reduced and reliable communication can be maintained. One of the secrets of success in being the first to accomplish two-way communication on five meters, lay in the building and calibrating of exactly duplicate wave-meters.

Simple Circuit Selected

Almost any circuit may be used for a transmitter at the higher frequencies as long as ordinary precautions are heeded. In designing the transmitters for the aforementioned stations, the de Forest ultra-audion circuit was selected because of its simplicity of operation and the small number of parts needed. Two pieces of copper tubing are used, one connected to the plate and the other connected to the grid, the opposite ends being joined together through a high-voltage variable condenser. The positive high voltage connects to the plate at the variable condenser through a radio-frequency choke coil, and the negative lead connects to the midtap of the filament transformer, from which also runs a lead through a resistance and another choke coil to the opposite side of the variable condenser, as shown in the diagram.

All that is necessary to tune this hook-up is to vary the condenser one way or the other, thus obtaining a corresponding change in wavelength, depending on an increase or decrease of capacity. If the capacity is not reduced excessively, there is no trouble with the circuit not oscillating, and all that is necessary in order to arrive at a definite wavelength is to have the correct length of tubing and the proper amount of capacity.



THE HEART OF THE TRANSMITTER

The type of vacuum tube used in the five-meter transmitter at 2EB. Note the simple condenser in the foreground

Strout and Phelps tried many methods of coupling this circuit to the antenna and after much testing of the various methods it was found best to use a voltage-feed arrangement. This facilitates the use of a long antenna, the lead of which is brought directly into the set through a coupling coil.

The antenna used for five-meter work can be constructed in almost any form. It has been found, however, that a comparatively long antenna works best, inasmuch as it may be operated at one of its harmonics. The far end must be supported free from surrounding objects. It is pointed out that if an antenna were used that was to be operated at its fundamental wave, it could only be slightly over a yard long for five-meter operation. With a long antenna, the last 50 inches of the wire, corresponding to a quarter wavelength of the transmitted wave at five meters, does the actual radiating. The remaining length down to the transmitter acts merely as a feeder wire.

A thermo-ammeter is usually inserted 50 inches from the end of the antenna, where the current may be several amperes. The ammeter is read with the aid of a pair of binoculars. This is the only way a good check can be obtained on actual radiation for a given wavelength. Three amperes are normally obtained at this point in midair at 2EB on a wave of 5.17 meters, or a frequency of exactly 58,000,000 cycles.

Receivers used for five-meter reception, like the transmitters, need be little different from those for longer waves. The main requisites are good shielding to avoid hand-capacity effect, solid connections, flexible socket leads and a shock-absorbing mounting for the detector tube.

"While the circuit in a five-meter receiver may be identical with a 40-meter receiver, the operation is not similar, and the results are often discouraging," said Mr. Phelps. "Here the regeneration control becomes interlocking with the tuning condenser, and any slight change in either affects the other. Slight changes in the filament rheostat shift the wave many cycles. Grid leaks become noisy and calibration is hard to maintain from day to day. Now that actual results are being obtained undoubtedly more time will be spent in the perfecting of better receivers.

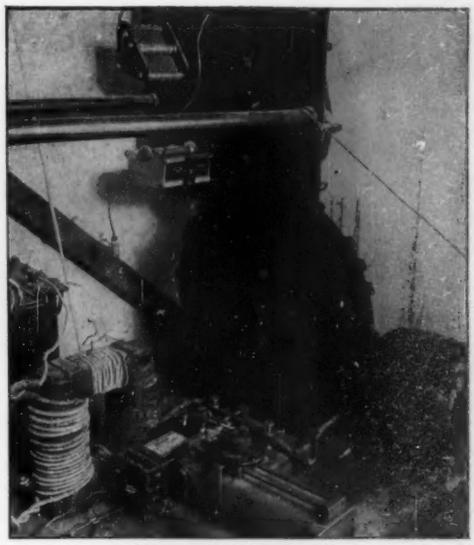
"One would imagine that when working on such short waves there would be but little trouble from interference. This, however, is not the case. Every automobile is a miniature interfering transmitter. All engines having electric ignition, such as those in automobiles, motor boats and even airplanes, cause interference. The disturbances are not concentrated at any one point on the dial, but are broad enough to cover the whole ultra-short-wave band. Certain types of motor cars have a tendency to tune with a maximum amount of interference at certain points on the dial, so that with a little experience an operator working on five meters could tell not only the make and model of a car before it got around the corner, but could also tell the condition of the spark plugs and the ignition wires."

Interest Is World-Wide

As international interest has been manifest in five-meter work, schedules having been inaugurated with amateurs in foreign lands. Observers are now on the job in all parts of Australia, New Zealand, California, Chile, Argentina, England, France, Italy, Belgium, Germany and Holland. Duplicate wavemeters have been sent to most of these locations by the American Radio Relay League.

Sufficient time has not elapsed for reports from most of the foreign countries. However, it was a great surprise to get verification that the signals were picked up on several occasions in the United States. Most theorists predicted that a "skip distance" of several thousand miles should be expected on five meters, while others were of the opinion that waves below 11 meters would radiate straight out into space and would not follow the curvature of the earth.

The amateurs are not the only experimenters in the kingdom of short waves. The research laboratories of the large electrical and radio manufacturing companies realize the possibilities in the short-wave band and they too are "seeking light."



THE AUTOMATIC KEY

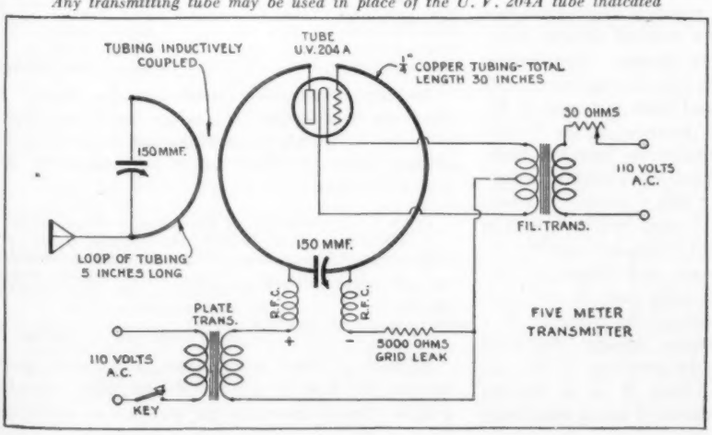
The large disk is rotated by the electric motor, and, making and breaking a circuit, it sends "2EB" automatically

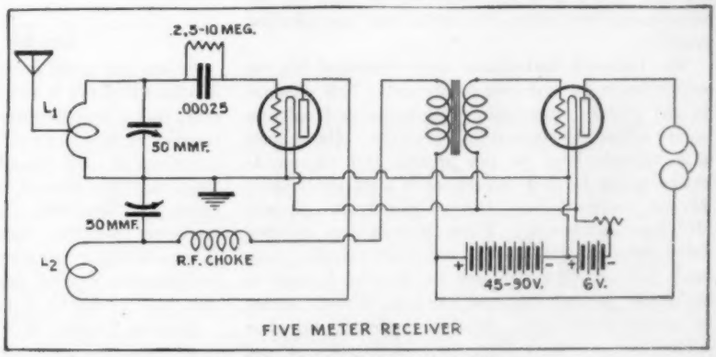
A radio listener in Australia, 11,400 miles from WGY, Schenectady, read with 100 percent accuracy messages broadcast on the 32.79-meter wave, although the signals were inaudible 200 miles from the transmitter, according to a report made by engineers of the General Electric Company, following a series of tests on the 32.79, 65.16, 109 and 140-meter wavelengths.

The conclusions reached by M. L. Prescott, engineer in charge of the tests are: channels comprising wavelengths shorter than those of the 66.3 to 75-meter channel will not give economical service at points within 100 miles of the transmitter. The 66.3 to 75-meter channels, the 85.7 to 105-meter waves and the 133 to 150-meter band are capable of rendering economical service to points within 100 miles of the transmitter. For daylight communication at distances not greater than 90 miles from the transmitter, the 133 to 150-meter channel will give superior service to the 85.7 to 105-meter waves. Similarly, the 85.7-meter waves will give better service than that which can be obtained under the same conditions using the 66.3 to 75-meter channel. The above conditions are reversed when distances between 90 and 300 miles are considered. In this case, the 66.3 to 75-meter waves will give better service during daylight than the 85.7 to 105 or 133 to 150-meter channel.

THE FIVE-METER TRANSMITTER HOOK-UP

In the diagram below, used by Strout and Phelps, RFC *consists of 100 turns of Number 28 wire on a one-inch tube. Coupling must be varied until the best results are obtained. Any transmitting tube may be used in place of the U. V. 204A tube indicated*





A REAL SHORT-WAVE RECEIVER

In the five-meter receiver, the diagram of which is shown above, the coil L1 *consists of one turn of ⅜-inch copper tubing, one and one-half inches in diameter.* L2 *is from one to two turns of the same size tubing, wound in a coil one inch in diameter. These coils are inductively coupled, and the distance between them must be varied until the best results are obtained.* RF *consists of 200 turns of Number 36 wire wound on a tube one inch in diameter. A high-ratio audio-frequency transformer is recommended*

The Month in Medical Science

A Review and Commentary on Progress in the Medical and Surgical Field

By Morris Fishbein, M.D.

Editor of the *Journal of the American Medical Association* and of *Hygeia*

Gallstones, Kidney-Stones and Diet

MUMMIES over 4,000 years old were found by Elliott Smith to have stone formations in the kidney. Since the time of Hippocrates, 400 years before the Christian era, physicians have attempted to account for the formation of calculi in the gall-bladder, in the kidney, or in the urinary bladder. When these stone formations occur, they give rise to symptoms that are painful and to complications resulting from obstructions that are serious.

Yoshitomo Fujimaki, of the Imperial State Institute for Nutrition in Tokyo, Japan, has just made public, in a report of Japanese research on nutrition issued through the Health Organization of the League of Nations, the results of some research bearing on the relationship of diet to the formation of stones. He points out that a perfect diet contains adequate amounts of protein, carbohydrate, fat, mineral salts and vitamins. He controlled all his experiments by feeding with a perfect diet. As a result of hundreds of feeding experiments, he found that animals kept on a normal diet did not develop calculi; neither did stones occur in animals kept on a vitamin-B-deficient diet, on a vitamin-C-deficient diet, on a vitamin-B and C-deficient diet, on a vitamin-A-deficient diet for a short time, or on a vitamin-A and C-deficient diet for a short time. On the other hand, animals kept on a vitamin-A-deficient diet for a long period formed stones. Bladder-stones were formed in a relatively short time, next kidney-stones, while bilestones took the longest time to form. Animals kept on a vitamin-A and C-deficient diet for a long period formed stones in the same way. The urinary stones were phosphatic in character while the biliary calculi were cholesterol stones.

It occurred next to the Japanese investigator to endeavor to treat the animals by modifying their diets. Rats fed on the vitamin-A-deficient diet and on the vitamin-A and C-deficient diet were examined with the X ray for the presence of the stones. Six rats were selected in which there were large bladder-stones. Their diets were changed to mixtures rich in vitamin A. It was found, according to his reports, that the stones had disappeared except for slight relics in some instances. The disappearance is credited to the fact that the urine had changed from an alkaline to an acid reaction. In the rats on the vitamin-deficient diets, the urine had an alkaline reaction.

The Japanese investigator then continued his experiments in an endeavor to determine how changes in the protein, inorganic phosphorus and calcium would affect the formation of stones. He reports that animals kept on the protein and vitamin-A-deficient diet formed concretions in a relatively short period, shorter indeed than when only the vitamin deficiency pertained. When protein was omitted from the diet, the rats did not form calculi. Animals fed on diets deficient in vitamin A, and in inorganic phosphorus and calcium, formed stones in a very short time. In these cases the bile-duct stones were formed first, then bladder-stones and finally kidney-stones. It will be remembered that in the previous experiment phosphatic calculi were formed. The bile-duct stones consisted of abundant calcium salts with cholesterol and pigment.

These investigations are striking in their results although the time is yet too short to permit drawing any definite conclusions as to their applicability to the case of man. Undoubtedly American investigators in the field of nutrition will repeat these experiments and control them suitably to determine just how far the conditions apply to the cause and treatment of stone formation in human beings. It has been known that stone formation tends to occur in the gall-bladder when there are bacteria present; indeed, carriers of typhoid bacilli frequently maintain a reservoir of these organisms in the gall-bladder, and bacteria have been found at the center of such stones. In the urinary bladder, stone formation will occur around any foreign material that may gain entrance. It has been established that herbivorous animals tend to form stones in a different manner than do omnivorous or carnivorous animals. All of these factors must be taken into consideration in determining what weight must be attached to the studies made in Japan.

The Isolation of Vitamins

INFORMATION coming from Germany indicates that Professor Windaus, a chemist of Göttingen, claims to have isolated a vitamin from cod-liver oil. His work has been carried out in collaboration with many discoverers elsewhere, including Dr. Alfred Hess of New York, Drs. Webster and Rosenheim of England and Professor Pohl, a physicist of Göttingen.

Evidence had accumulated to indicate that the antirickets vitamin is produced from a substance which was tentatively called a provitamin, appearing when foods and oils had been submitted to ultra-violet light. Provitamin seemed to have the nature of stearin, which is found in small quantities in all vegetable and animal oils and fats. Cholesterol is a stearin, and when irradiated with ultra-violet light, it develops antirachitic powers.

By means of high-vacuum distillation, Professor Windaus apparently produced a preparation which was nine times as potent in provitamin as previously. This preparation constituted an unsaturated compound related to cholesterol. The substance credited with having the power is ergosterin, which when irradiated has definite therapeutic effects on rickets in rats. It is assumed that the submission of this substance to ultra-violet rays brings about a change from provitamin to vitamin. The details of the changes are yet to be determined.

Amebic Dysentery

IT has for years been a common impression that amebic dysentery is strictly a tropical disease. However, recent investigators have shown a considerable number of infections of this type among immigrants examined at Ellis Island, and there is reason to believe that the disease will increase in the United States with the influx of immigrants from the Mediterranean countries. Occasional cases have been seen in practically every state in this country. A recent investigation showed that 35 cases had been seen in one year in the Cook County Hospital in Chicago.

Doctors Kaplan, Williamson and Geiger, of Chicago, report an epidemic of eight cases in one large public hotel in Chicago, due to the presence of a carrier of amebic dysentery, among the food handlers. In determining the presence of the carrier, specimens of the excretions of all of the employees of the hotel were examined and it was found that two, a "pantry girl" and a "vegetable girl," were carrying organisms known as *Endameba histolytica*, which produce this disease. Moreover, a Syrian cook was actually ill with the disease and was still employed at night duty at the time the examinations were being undertaken.

In the cases of the patients seen in Cook County Hospital in Chicago, most of them gave a history of having worked on railroads and using water of unsanitary quality for drinking purposes.

The disease is controlled with difficulty, and is sufficiently serious to demand the best possible medical attention when its presence is discovered.

Bigger Boys

According to Franz Boas, increases in the stature of children are occurring among various people in Europe. Dr. Horace Gray, of the Institute for Juvenile Research in Chicago, compared the measurements of Boston boys made by Bowditch in 1879 with the measurements of 303 Boston boys which he himself made recently. The investigation indicated that American-born boys of American-born parents are today taller than boys of fifty years ago by more than two inches. No explanation is offered.

Inheritance of Physical Characteristics

ONE of the problems regularly before the courts is the definite determination of the parentage of a child of doubtful paternity. Quite recently it has been shown that every person possesses in his blood certain substances that have the power of agglutinating or dissolving the blood corpuscles of other persons' blood. It has been shown that all human beings may be divided into groups according to the manner in which their blood reacts towards that of others, and this grouping is an hereditary factor.

In addition to these blood groups, the color of the eyes may be used in aiding the decision as to heredity, since it is known that blue eyes are recessive to dark eyes and that blue-eyed parents always have blue-eyed children. Dr. Laurence H. Snyder presents a table showing how the eye color may be considered in determining parentage:

TABLE 1.—*Determination of Parentage by Means of Eye Color*

Eye Color of Known Children	Eye Color of One Parent Known to Be	Eye Color of Other Parent Must Be
Brown	blue	brown
Brown	gray	brown
Gray	blue	gray or brown
Gray and brown	blue	brown
Gray and brown	gray	brown
Blue and brown	blue	brown
Blue and brown	gray	brown
Blue and gray	blue	gray or brown

Another investigator found that the manner in which the hair on the back of the head forms itself in circles or whorls is an important factor in determining heredity. This factor is covered by the following table:

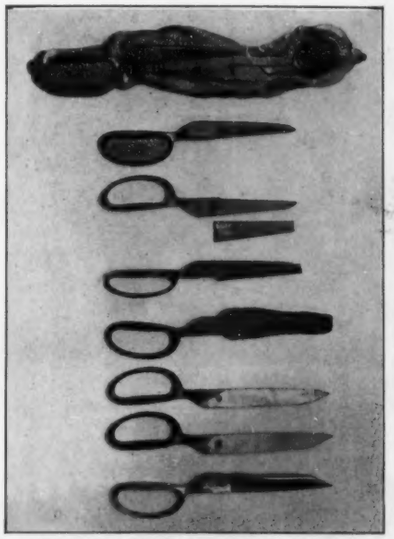
TABLE 2.—*Determination of Parentage by Means of the Direction of Hair Whorl in the Occipital Hairs*

Direction of Known Children	Direction of One Parent Known to Be	Direction of Other Parent Must Be
Clockwise	counter-clockwise	clockwise
Clockwise and counter-clockwise	counter-clockwise	clockwise

As such evidence accumulates, it becomes apparent that the time is not far distant when scientists will be able to determine the question of parentage.

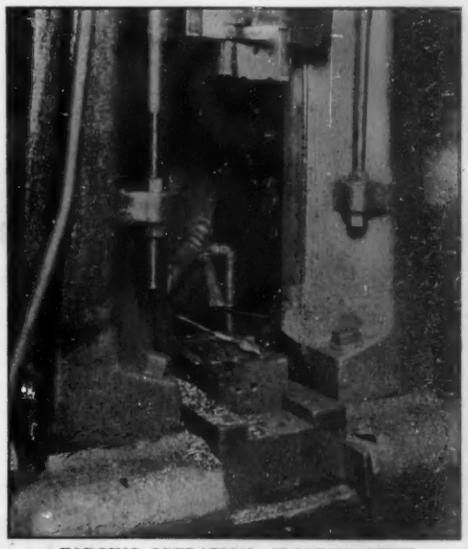
HAND-CHIPPING DIES FOR FORGING

Milling machine does preliminary work, but details of the finished forging are cut into steel block by hand



STEPS IN MANUFACTURE OF SHEARS

TOP TO BOTTOM: *Excess metal removed; steel cutting-edge welded on; blade ground and polished*



FORGING OPERATION—CLOSE UP VIEW

The dies have three sets of impressions. Work is moved from one to another. About eight blows are required

Courtesy of J. Wiss & Sons Company

"WET GRINDING"

Blades are ground on large abrasive wheels running in water. Work is pressed against wheel by the lever

POLISHING INSIDE OF RING HANDLES

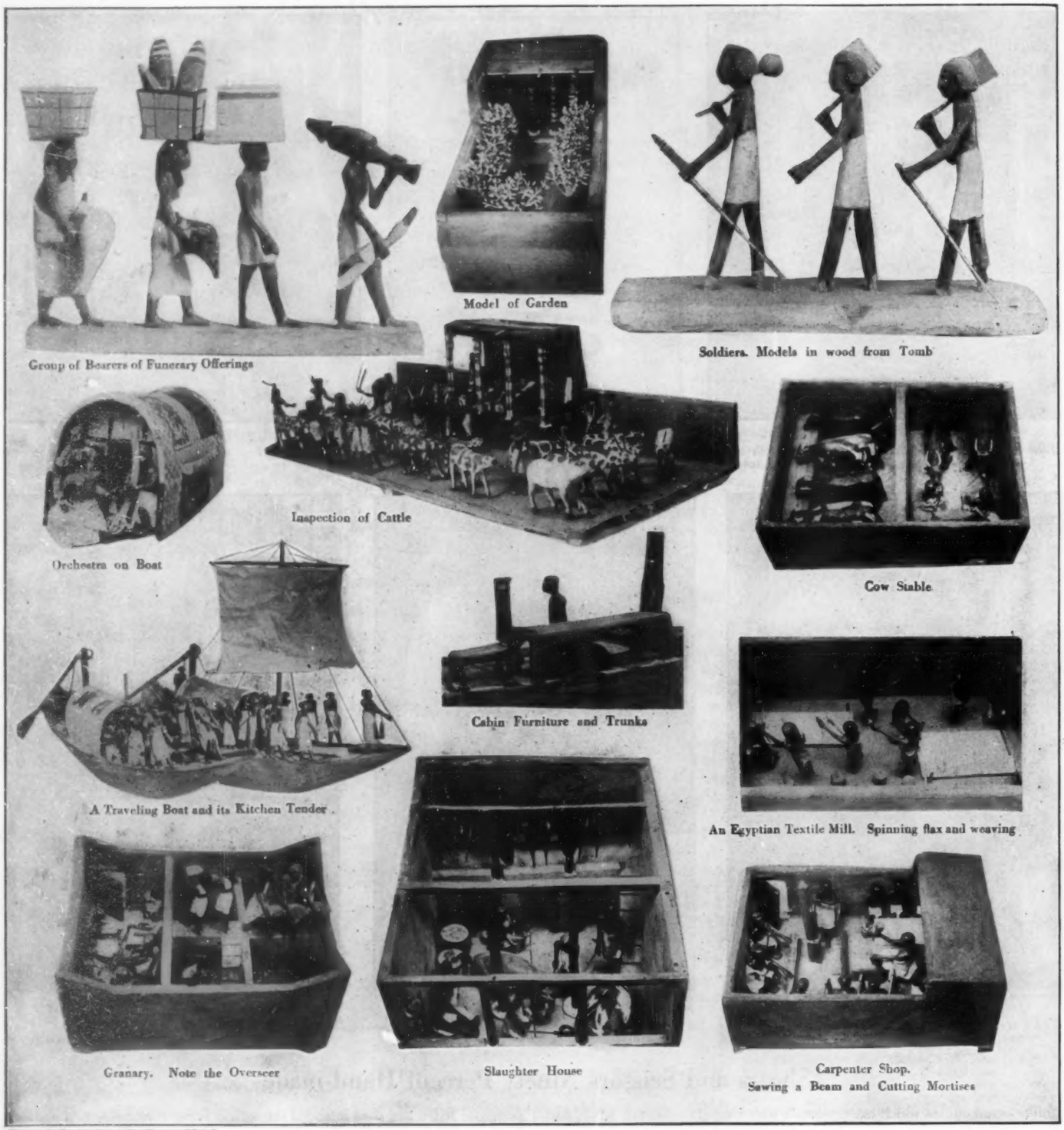
A high-speed flexible abrasive belt smooths inside surface of the handles. (Note dust protection)

BLADES ARE PAIRED TEMPORARILY

Temporary screws hold blades during adjusting. They are polished separately; then attached permanently

Shears and Scissors Ninety Percent Hand-made

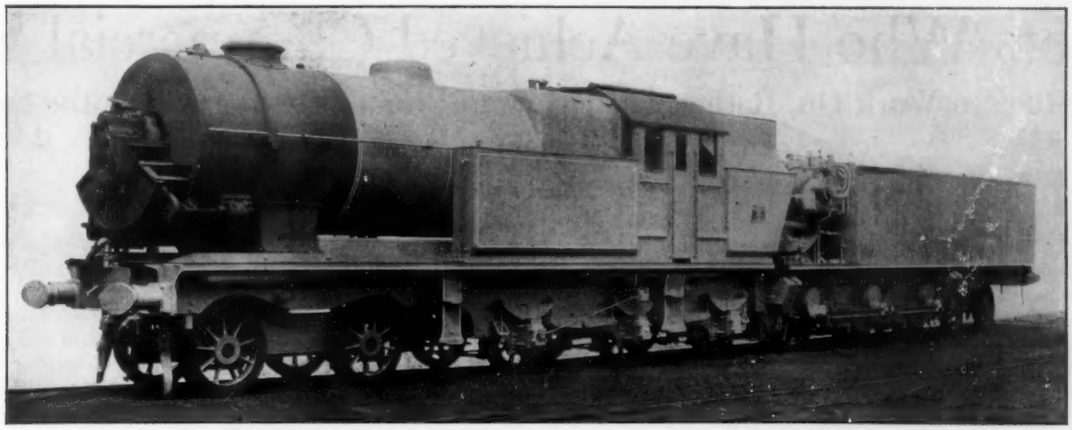
Unlike commodities which are produced with very little human labor, fine shears and scissors are still made almost entirely by hand. About 90 percent of their manufacturing cost is represented by skilled labor. In the United States, during the past 100 years, there have been numerous improvements in the construction of shears, but the percentage of skilled labor has been reduced little, if at all. The largest part of the labor in manufacturing shears is expended on grinding and polishing operations, and the adjustment of one blade to the other. Attempts have been made to devise automatic grinding and polishing machinery. Several such machines have been reasonably successful for work on certain styles and sizes. However, in this industry, many different patterns and sizes are required; and so far no machine has been built that will grind or polish blades of different sizes without very extensive adjustments (which would almost amount to doing the work by hand). The distinction between shears and scissors is not very clearly defined. Generally the term shears is used to designate styles and sizes intended for cutting heavy materials, with handles large enough for the thumb and two or more fingers. The term scissors generally means a smaller tool, with ring handles for the thumb and one finger. Fine quality shears have blades made of two different kinds of steel. The back of each blade and the handle are drop forged from medium-carbon steel. This part is strong enough to stand severe strains. The cutting edge of high-carbon steel is first riveted and then welded fast to one side of this forging. The blade is then hardened in cold running water and tempered in oil. The high-carbon steel cutting-edge becomes extremely hard, while the handle and back of the blade are only slightly hardened and remain tough and strong. The blades of scissors are forged from one piece of steel, because the process outlined above cannot well be applied to small work. In scissors, great strength is not required, and a compromise is struck between strength and hardness. By doing this, the finished product may be said to be a happy medium for the work to be done.



Photographs Courtesy Metropolitan Museum of Art

Models Show Ancient Egyptian Life and Industry

In our December, 1926 issue, we presented two pages of illustrations detailing manners and customs of the ancient Egyptians. Would it not be very valuable from an educational point of view if we were able to show, by means of doll-like figures, how these Egyptians really lived and traveled and fought? It was a great surprise when, a few years ago, one of the cliff tombs of Thebas gave up 24 perfectly made models, depicting life in Egypt as it was 4,000 years ago. During the clearing of fallen rock in one of the tombs, a small, dark hole was found. Soon there was revealed a miniature world, more or less in disorder from debris, but all there. There has rarely been a more dramatic find in all archeology and now we have the figures safe for all time in the Metropolitan Museum of Art. The beautiful little objects were buried near the tomb of Mehenkwetre, chancellor and steward of the royal palace about 2000 B. C., to serve him after death. Largest of all is the model shown in the center of this page. Here we find the noble in the courtyard before his house counting his cattle, which are being marshalled before him. The figures are eight or nine inches high. Above this is shown a little garden with each leaf of the fig trees pegged in place. When the noble traveled, he used two boats—one for himself and party and one for a kitchen tender. The industries which we illustrate need no further explanation.



THE LJUNGSTRÖM LOCOMOTIVE ADAPTED TO BRITISH CONDITIONS

Here is illustrated the completed turbine locomotive as tested on the London Midland and Scottish Railway. The forward part houses only the firebox and boiler, while the power plant is carried in the rear part, which replaces the usual "tender"

Turbine Locomotive for British Railroad

Engine Is in Two Sections, Coupled by Ball and Socket Joint

By F. C. Livingstone

TESTS have recently been carried out on the London Midland and Scottish Railway (Great Britain) of a new type of locomotive, which, if adopted for general use, will make a change almost as radical as that made by the introduction of electricity for the operation of trains. This locomotive is of Swedish invention and was built by Messrs. Beyer, Peacock and Company, Limited, at Manchester.

In general arrangement the engine is very similar to the original Ljungström turbo-condensing locomotive which was built in Sweden in 1921 by the Aktiebolaget Ljungströms Angturbin, and subsequently put into service on the Swedish State Railways, but it has been designed to conform to the British loading gage and operating conditions. It has a total boiler heating surface of 2,260 square feet, of which the tubes represent 1,480, the firebox 140, and the superheater 640 square feet. The maximum tractive effort is approximately 38,000 pounds, and the maximum speed in the neighborhood of 75 miles per hour.

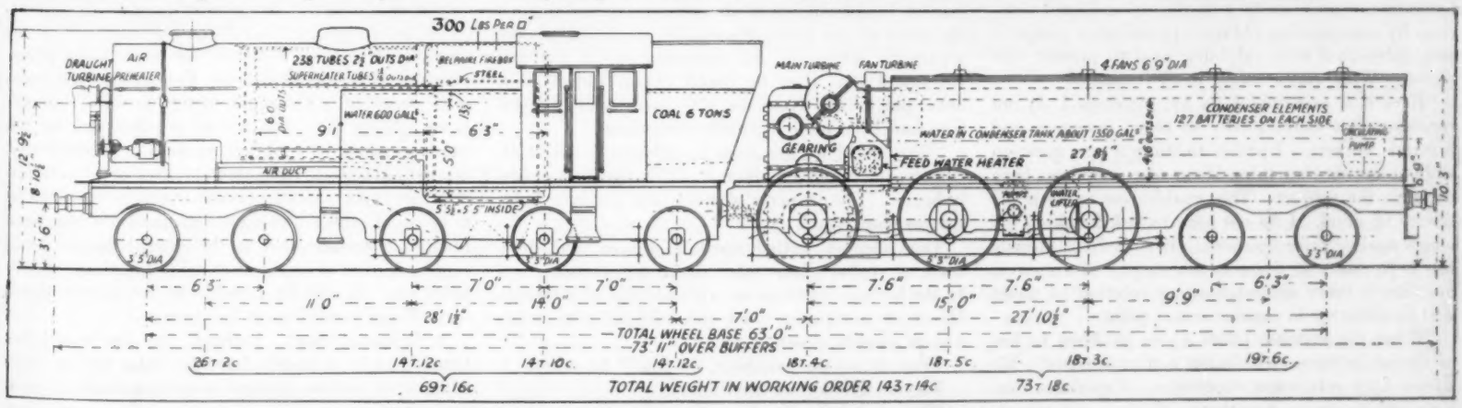
Whereas the complete locomotive has much the same appearance as an ordinary engine and tender, actually the purpose of the leading vehicle is the conveyance only of the boiler, and of the rear vehicle the accommodation of the power unit, the turbine and condenser—the power being conveyed direct from there to three pairs of coupled driving wheels five feet, three inches in diameter, under the same rear vehicle. The front, or boiler-carrying portion is mounted on three fixed axles and a leading four-wheel bogie, all the wheels being three feet, three inches in diameter. The boiler has an outside diameter of six feet and measures nine feet one inch between tube plates. It contains 238 two and one-half-inch steel tubes, and the superheater is of the M.L.S. small-tube type. The working pressure is 300 pounds per square inch. The Belpaire pattern firebox is fitted with an inner firebox of steel with steel stays.

2,000 Horsepower Turbine Used

At the front of the smokebox is a turbine-driven, induced-draft fan for the air preheater. The latter is of the Ljungström patent design, and possesses a rotor fitted with thin nickel blades. To enable easy access to the tubes it is interesting to note that the whole of the smoke-box apparatus is mounted on hinges. The heating surface of the air preheater is approximately 13,500 square feet.

The main turbine, which is carried on the front of the second portion of the locomotive, develops 2,000 horsepower at 10,000 revolutions per minute. The drive is conveyed to the front pair of coupled wheels by means of direct double-helical, three-reduction gearing of a ratio of 1 to 25.22, the final drive from the last gear shaft to the driving axles being by means of a quill or hollow axle operating through links and thus providing a flexible connection. The middle and trailing wheels are coupled by side rods with outside cranks, the total weight on the coupled wheels being 109,200 pounds.

The Ljungström patent air-cooled condenser is used with an auxiliary water-surface condenser. The main condenser body carries approximately 1,350 gallons of water, forming the supply for the boiler. Exhaust steam from the turbine is forced upwards by a circulating pump through the copper condenser-elements. These tubes, which are approximately 2,500 in number, are flattened and ribbed. They are arranged in batteries and are placed vertically on each side of the condenser to top and bottom housings. The top collectors receive exhaust steam from the turbine and the bottom collectors receive the condensate. Condensation is effected by air which is forced through the spaces between the tubes by four fans six feet, nine inches in diameter, driven off the pump shaft. The boiler is fed by means of turbine-driven centrifugal pumps, the water being forced through the tubulus feed-water heater. The cooling surface of the condenser is approximately 13,500 square feet, an area similar to the heating surface of the air preheater. Movement between the two portions of the locomotive is allowed for by the use of a ball-and-socket joint.



CROSS-SECTION OF NEW TYPE OF TURBO-CONDENSING LOCOMOTIVE

Weights and dimensions of all of the important parts are given here. Notice that the fuel is carried in a bin which is an integral part of the front unit. The steam is conveyed to the turbine in the rear unit, and after it has delivered its power, it is led to the condenser. The details of operation are explained in the text above

Inventors Who Have Achieved Commercial Success

What Idea to Work On, Rather Than How to Promote Inventions, Is the Subject of the Sixth Article of This Series

By Milton Wright

"THE difficulty is not to invent, but to choose among the multitude of ideas that come to one's mind, the one which will be worth while."

Georges Claude, one of France's most distinguished inventors and scientists, said that in a lecture at Columbia University and when we read it, we resolved to ask him more about it. We had been writing about the manner in which inventors *promote* their inventions; for a change we would talk about the way they *produce* them.

You probably have seen at least one of Monsieur Claude's inventions—the neon light, extensively used in advertising signs. One of them is atop the Scientific American Building—orange-red letters four feet high which spell out the name of this magazine. You may see such lighted signs in nearly every city in the country.

Then there is the dissolved-acetylene industry, created by M. Claude. Every year in the United States it produces 400,000,000 cubic feet of acetylene worth 10,000,000 dollars. By the Claude process, oxygen and nitrogen are produced on a large scale by the Air Reduction Company. Nowhere in the world has there existed such an accumulation of nitrogen apparatus as at Muscle Shoals, equipped during the World War with 30 sets of apparatus, each with a producing capacity of 15,000 cubic feet per hour. The apparatus was invented by M. Claude.

One Discovery Leads to Another

A still later invention of his is a process for the synthesis of ammonia by hyper-pressures. The Du Ponts have undertaken development work on this project in the United States.

"Now about choosing the invention to work on," we asked him. "How do you decide which invention to invent?"

"The one that is simplest," he replied. "Only simple solutions are worth considering. We should do things in simpler, easier ways than they were done a hundred years ago, even though there seem almost insurmountable difficulties in arriving at the solution to the problem.

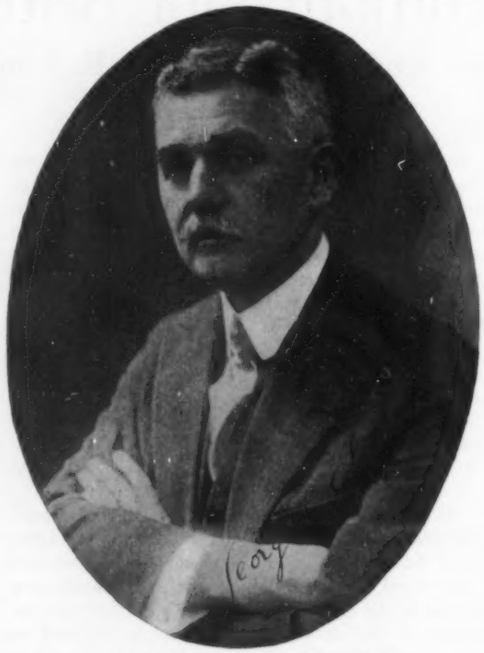
"There always is a way to solve the problem. Sometimes the solution is unorthodox, but that need not make you hesitate. I recall that during the war I solved the problem of manufacturing liquid chlorine, by compressing chlorine in ordinary compressors, lubricated with sulphuric acid to prevent corrosion. What could sound more fantastic?

"Here is a principle I go by, although I do not recommend it unreservedly to other inventors and research workers. I prefer to study a new question without knowing anything about what may have been done on the subject. This enables me to keep my liberty of mind. I do not have to risk breaking my wings against false opinions. If something already has been done, so great is the variety of resources possible in every subject, that my solution no doubt will be different in some essential point.

"When the inventor starts a new problem he has to choose between calculation and experience. My advice is to rely upon experience. Experience forgets nothing in its equations. Such is not always the case with mathematics. Often experience instinctively will give results capable of determining whether this reaction or that is ridiculous or wonderful."

When M. Claude discovered the remarkable dissolving power of acetone for acetylene, he was able to store this acetylene in great quantities under low pressures. Diluted in an inactive liquid, the acetylene gas would not explode. Thus was created the dissolved-acetylene industry, so important in the welding and cutting of metals.

One discovery has led to another. The desire to prepare economically carbide for the production of acetylene led M. Claude to study the economical extraction of oxygen from the air. Several methods



INVENTOR OF THE NEON LAMP

"Only simple solutions are worth considering," is part of his message to inventors whose goal is commercial success

were tried, all of them ineffectual, until at last he hit upon liquefying the air. He found he could use not only the separating effect between oxygen and nitrogen, which takes place during the evaporation of liquid air, but at the same time, and against the ideas of Sir John Dewar, that he could use the separative action of the condensation of the air. He found that thus he could obtain industrially, neon and helium from the air—gases which heretofore had been mere scientific curiosities.

"How could we use neon in industry?" asked M. Claude, in telling us about it. "By creating a new industry. The property of neon is to produce light. Let me show you."

The scientist pulled open a drawer and drew forth a sealed glass tube about ten inches long. In the bottom rested about a thimbleful of mercury. He strode across the room and held the tube inside a dark clothes closet.

"You do not see anything, do you?" he asked.

No, we did not see anything.

"Now watch." He shook the tube up and down. A fiery, orange-red light leaped up and down.

"Very simple," he explained. "The tube is filled with neon gas. The friction of the mercury against the glass generates electricity and the neon gas lights up.

"Of course, there have been difficulties with neon. It is extremely sensitive to impurities. I overcame this by a process of forming the tubes which captured the offending molecules in a small receptacle of coal cooled by liquid air. I was able to diffuse the atmosphere in the tube because of the slow circulation. Then there was the progressive disappearance of the neon from the tubes, limiting their duration to a few hours. I found the reason for this disappearance to lie in the absorption by the metal which is thrown against the side of the tube by the electrodes. Knowing the cause, we could remedy it. Since 1911 we have been producing tubes which have a very long life because we use electrodes of sufficient surface. It is these tubes which are now used extensively for electric signs."

Like many French scientists, much of M. Claude's work has been done to benefit his country. French industry, exhausted by the war, needed many things, among them being synthetic ammonia. Germany had made great strides during the war through the famous Haber process used by the powerful Badische Anilin. France had not the gigantic means at her command that Germany had, so M. Claude resolved to rely upon efficiency. Although engineers were unanimous in declaring that he was on the wrong track, he resolved to work with high pressures. His efforts met with success. The most important use of ammonia is its transformation into fertilizer.

Power from Sea-Water

"It is but one example of the enormous consequences that can result sometimes from a fact which would appear rather insignificant," he said. "We transform, in the natural potash, the chloride of sodium, which is harmful to vegetables, into chloride of ammonia, which is useful. We transform ammonia into a fertilizer, not with the aid of sulphuric acid, which is expensive, but with chlorine which we obtain free of cost. Without cost, also, we produce enormous quantities of carbonate of soda."

But these achievements are past. M. Claude is now at work with Paul Boucherot, eminent French electrical engineer, upon what he believes will be the crowning work of his career—using the thermic energy of the sea for the production of motive power.

"It is simplicity itself," he declares. "In the tropics, the surface water of the ocean is at a temperature of about 28 degrees, Centigrade; the water at a depth of a thousand meters is only four degrees. Bring these two waters together and we can produce steam in a partial vacuum. Theoretically, this will do work equivalent to that of a waterfall 300 feet high. Motive power could be obtained at a price of about the rate furnished by the most favored waterfalls and at the same time we could supply cold at a low cost to take the place of artificial ice. It will be possible to completely transform living conditions in the tropics."

A fantastic idea? Perhaps, but the world has laughed at M. Claude's fantastic ideas before, only to have its guffaws change to exclamations of wonder. He is now seeking a site to set up a test plant and his past successes promise that his newest undertaking will be full of interest.

All Photographs by Wide World

MR. J. ROBERT ATKINSON, PUBLISHER OF THE *BRAILLE MIRROR*

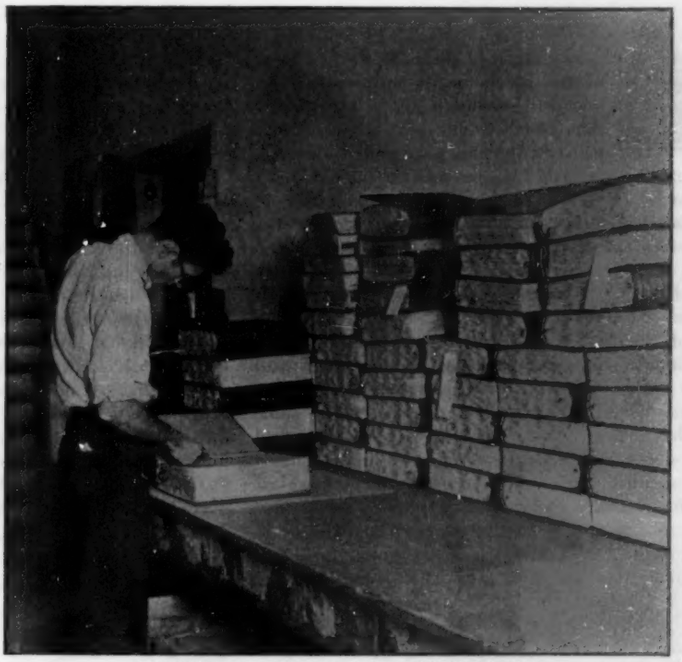
The Braille Mirror *is a 60-page monthly magazine published in raised type. Mr. Atkinson is shown reading page proofs in Braille*

A BLIND OPERATOR SETTING BRAILLE TYPE

This is one of the machines invented by Mr. Atkinson, who turned to inventions for the blind when stricken with the loss of his sight

ROBERT R. GOODELL, THE PRESS-ROOM SUPERINTENDENT

The Braille Mirror *is printed on wet paper. Here, finished copies are being placed on special racks in order that they may dry thoroughly*

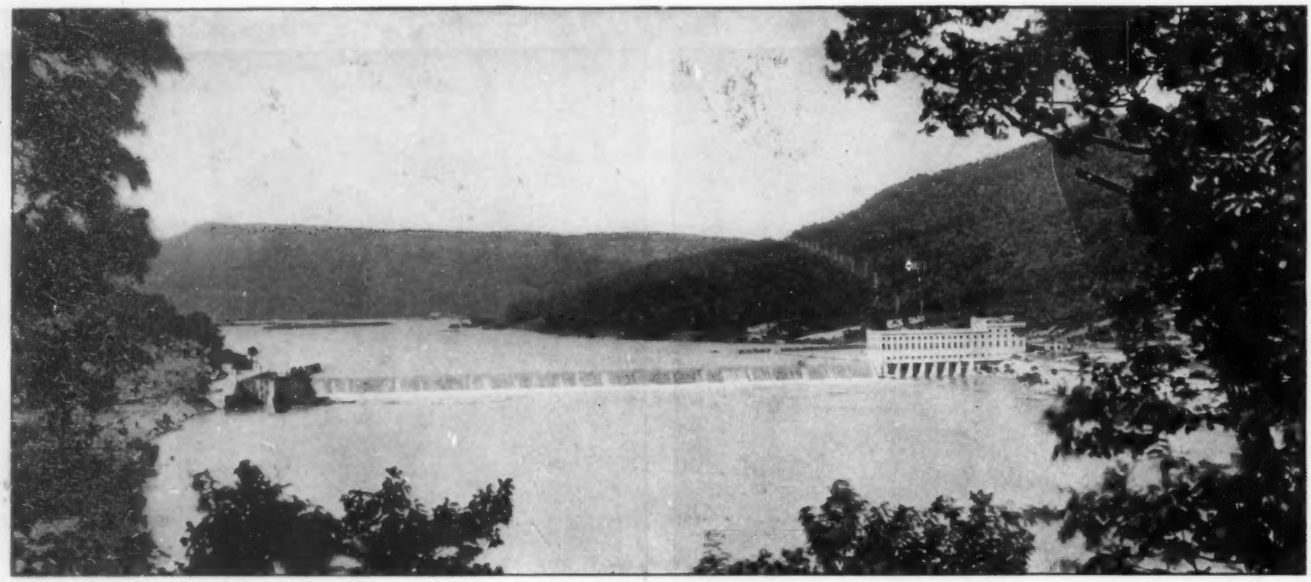


BINDING THE BIBLE, SET IN BRAILLE TYPE

The entire Bible comprises 21 volumes like those shown—2,485 pages—and costs 80 dollars. It has given endless comfort to the blind

Blind Editor Publishes Journal for the Blind

One of the several existing journals for the blind is the *Braille Mirror*, published in Los Angeles by Mr. J. Robert Atkinson, who is shown in the photograph at the top left. At 35, Mr. Atkinson was stricken blind. At once he turned to the problem of journalism for the blind, made a study of it, invented special presses and stereotyping machines for Braille type and became the publisher of the interesting monthly magazine named above. This journal even carries advertisements in raised type. Lucille Goldthwaite, Librarian for the Blind in The New York Public Library, told the editor of the Scientific American that few realize how very limited are the books in Braille, for the blind. "In all," she said, "there are not more than 900 of them. About 24 magazines are published in Braille in England, but here in America there have been less than half a dozen. This country adopted Braille as its standard type for the blind about eight years ago, and we are just beginning to acquire an adequate collection. One of our needs is additional good magazines in Braille, and Mr. Atkinson has gone far to supply this need. The *Braille Mirror* is published in 'two-side' print —that is, on both sides of the sheet—a method which is just being introduced into America. This method makes a Braille magazine more compact."



HALE'S BAR, TENNESSEE RIVER

This attractive view of hill-begirt river and lake owes not a little of its charm to the far-flung dam, flanked by lock gates and stately power house. The plant, 21 miles below the city of Chattanooga, Tennessee, comprises 14 units, totalling 50,000 horsepower. The dam is 1,200 feet long and the head is 35 feet

Uncle Sam, Spendthrift—X

We Have 55,000,000 Potential Horsepower In Our Rivers, of Which We Waste 44,000,000

By J. Bernard Walker

IF you have read the preceding chapters of the present series on conservation, you will doubtless agree that Uncle Sam has been playing the spendthrift with the priceless patrimony with which Nature has enriched his country. We are inclined to doubt whether, in all history, there can be found an instance where a people entered into possession of virgin territory that was so lavishly endowed with natural resources as the vast stretch of country which has come to be known as the United States of America. It is a question, moreover, whether any people in the 6,000 years of recorded history and tradition has squandered its natural resources with such a total disregard for the future as ourselves.

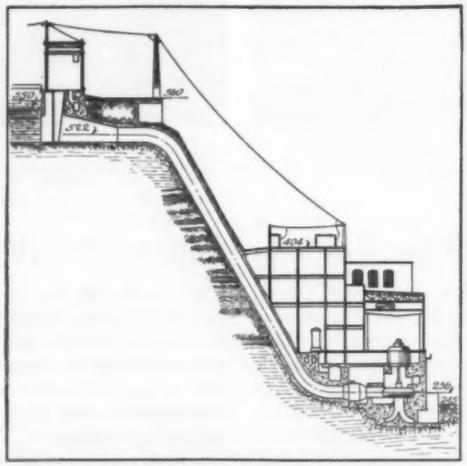
Four-fifths of our virgin forests are gone; some of the richest of our coal beds have been worked out; our priceless reserves of oil are being consumed at a steadily accelerating rate; some of our choicest sea foods have been fished to the point of extinction; the vast herds of game that roamed the prairies and forests of the virgin lands have shrunk to a few remnants that are sheltered in our game reserves; and it is only in the last few years that the lovers of bird life have been making a desperate struggle to save what remains from suffering the fate of those species that have been completely wiped out by the greed or by the thoughtlessness of the hunter.

Utilize Water Power to Conserve Coal

Now, although the above is a sufficient indictment, there remains yet another field in which we have been guilty of waste—this time indirectly. We refer to the neglect to make adequate use of the magnificent system of rivers and lakes which forms one of the outstanding natural features of the United States.

It may be asked how the failure to control and use the flow of our rivers can be called an act of wastefulness. The moisture evaporated from the ocean is carried over the land, deposited on the plains and mountain ranges and returns by gravity to the seas and lakes; and the phenomenon represents merely one of those great cycles of activity that mark the course of Nature. If man fails to control these processes by conserving the floods of the rivers for power development, for irrigation, or to assist in navigation, how can his failure be charged against him as wastefulness? The answer is that the horsepower which he fails to develop from rivers and streams must be obtained by the consumption of its equivalent in coal and oil, and that the failure to dam the flood waters in the upper reaches of the rivers results in devastating floods.

Proper control would not only save the fertile farms of the valleys and plains from damage, but would make it possible to bring under cultivation the naturally fertile soil which now exists as barren and uninhabited desert land. The Government estimates that if our rivers were fully controlled, an area of desert lands equal to the whole state of Maryland would be brought under cultivation, and 55,000,000 hydroelectric horsepower would be made available for industrial use. At one and a half to two pounds of coal per horsepower-hour, this conservation of water power would mean an eventual annual saving of about 200,000,000 tons of coal. Thus we waste by indirection.



GREAT QUEENSTON HYDRO-ELECTRIC PLANT

This famous plant utilizes full head, 366 feet, of Niagara River between Niagara Falls and Queenston, Ontario

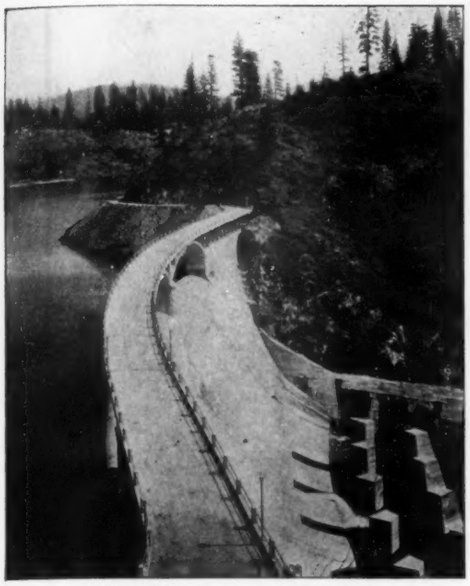
Furthermore, the regulation of the depth of our lakes, rivers and streams by suitable hydraulic works would provide a system of cheap transportation for certain commodities which now are carried by the over-burdened railroads at necessarily high rates. The failure to provide this cheaper transportation is another instance of wastefulness.

When the country was first settled, the newcomer had to depend upon his own right arm in prosecuting his pioneer labors. Lumber he had in abundance; but he knew nothing, nor did the rest of the world for that matter, of the steam engine, the oil engine or the electric motor. There were two sources of power however, with which he was familiar—the windmill and the water-wheel. The former, because of the densely forested terrain, he could not use; but he found among the New England hills and valleys many a swiftly running stream, that gave a good supply of water the year 'round. Hence, the water-wheel became the universal source of motive power.

Early Industries Used Water Power

The individual plants were small, for the demand was limited. However, throughout the Colonial period and indeed for a full century after the formation of the republic, water-wheels were used for cutting up lumber, grinding corn, and running the small factories which gradually sprang up to meet the demands of the local population.

We are reminded by Mr. O. C. Merrill, Executive Secretary of the Federal Power Commission, that the earliest industries were built up around the mill sites of New England, where many small streams furnished opportunities for power plants, either at "falls" or by the construction of dams. These were low-head plants; and heads of over 20 or 30 feet were frequently subdivided into two or more drops, with canals constructed at different levels.



DIVERSION DAM AT PIT RIVER

In this California project, a diversion dam, traversed by a highway bridge, serves to form Lake Britton

As the descendants of the first settlers began to move westward, they reached the coal mines, and where water power was not available, fuel power-plants were established. Moreover, as rail transportation was improved, the price of coal fell and supplies became readily available. Hence, power plants driven by coal soon became the prevailing practice. Naturally, the location of coal mines determined the location of the industries of the country, and today over one-half of the bituminous coal mined is used in five states—New York, Pennsylvania, Ohio, Indiana and Illinois. Moreover, over 75 percent of the steam engines, turbines and water-wheels are located in the section east of the Mississippi River.

The development of the art of generating and using electrical power brought about a complete change in the distribution of the country's industries, for it was no longer necessary to use the energy in or adjacent to the generating plants. The latest electrical development, and one which will tend toward great economy and convenience, is the creation of huge super-power systems, in which a large number of plants feed their power into a common system of electrical transmission. There is one in the southeastern states which covers a territory of 140,000 square miles, and another on the Pacific Coast which serves 200,000 square miles—a territory which has about the area of France.

It was inevitable that the rapid increase in the use of rivers and streams in the development of hydroelectric power would raise the question of the respective authority of the Federal Government, of the states, and of the owners of private plants in the matter of the use of the natural water-powers of the United States. To meet the situation, Congress, in 1920, passed the Federal Water Power Act, a measure which already has proved so helpful, and promises to assist so greatly in the wise and just distribution and development of water power that we give herewith a few of its most vital provisions:

Permanent public ownership and control of power sites on lands of the United States and of power privileges in navigable and international streams.

Development of such power sites and power privileges by private or public capital under public supervision and regulation.

Authority for such development to be given in the form of licenses limited to 50 years' duration, unalterable for their terms and issued at the discretion of the administrative au-authority.

At the expiration of the license, the United States to have the option of acquiring the properties of the licensee for its own use, or requiring their transfer to another, or of issuing under the terms of then-existing law a new license to the original licensee.

If the properties are taken over by the United States or transferred to another licensee, the original licensee to be granted adequate compensation for the properties taken.

Plans of projects to be so drawn as to provide for, or to be adapted to, the comprehensive scheme of development of the regions for all beneficial public purposes.

A common policy and a single executive agency in the administration of all water powers under federal control.

Local Politics Delay Progress

Commenting on the present situation as regards water-power development, including the very important passage of the Federal Water Power Act, Secretary Hoover points out that all this has brought us to the threshold of a new era in utilization of the various resources of water, where we must broaden our foresight and determine great policies and programs. "We must no longer think," he says, "in terms of single power sites, or single storage dams, or single land projects, or single navigation improvements: we must think in terms of the coordinative long-view development of each river system to its maximum utilization."

THE NOTCH IN THE HORSESHOE

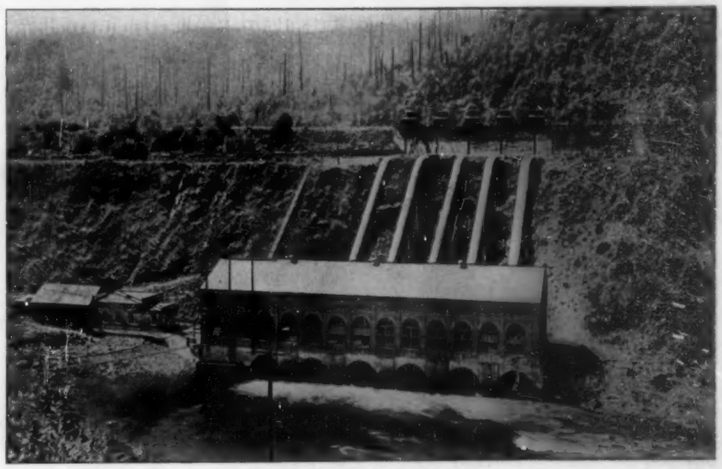
Nine-tenths of Niagara passes over the Horseshoe Falls, which is being cut further back every year

But, alas, thanks to a lack of intelligence, to the want of a broad outlook, and to the tendency to indulge in local politics rather than play the game on a national scale, Congress, when it comes to legislation affecting certain great definite projects, has too often been the very worst enemy of any grand scheme of coordinated national water-power development. As Mr. Hoover says, "We have to face the regrettable fact that these great possibilities of development of water resources are fast driven into the muck of litigation, political opposition and interstate quarrels."

These are strong words but they are not any more strong than they are true; as witness the recent disgraceful scene in the Senate, when a small minority of men conspired together to hold up the bill for the construction of the great Boulder Creek Dam for the control of the flood waters of the Colorado River. The United States Senate does not stand so high in the estimation of the country that it can afford to play fast and loose with the great national problems which come up for its deliberation. The Boulder Creek Dam is no fly-by-night scheme put forth by some petty politicians. It is a greatly needed work of engineering which has behind it the

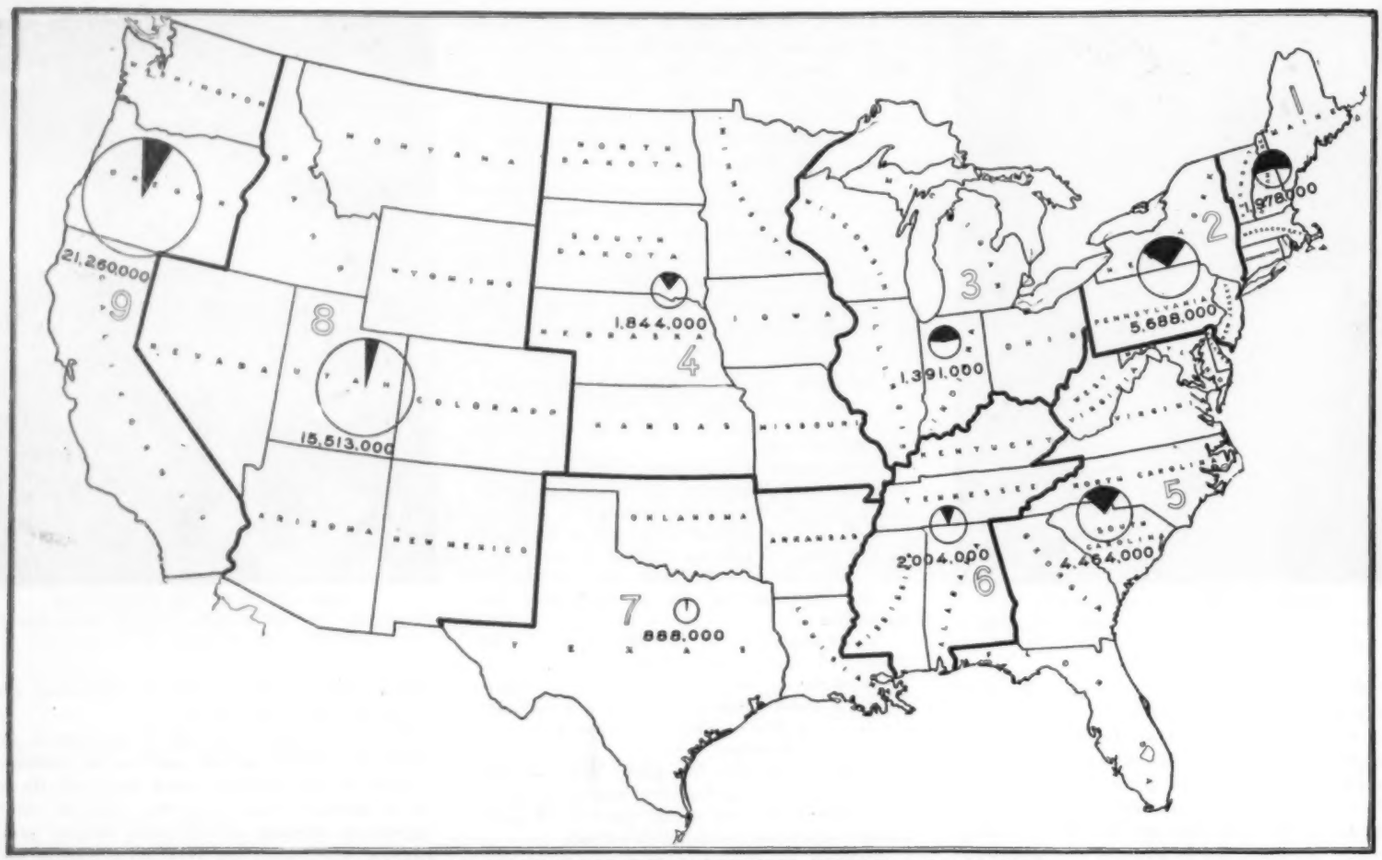
REMMEL DAM, ARKANSAS

Dam in Hot Springs National Park, built by Arkansas Light and Power Company on the Caddo River. Note wall-and-buttress construction at the ends



CAZADERO POWER PLANT

Utilizing the Clackamas River 35 miles from Portland, Oregon. Head, 128 feet. Generator capacity, 19,700 horsepower. Hidden in rocky ravines are many such plants



PRESENT DEVELOPMENT OF UNITED STATES WATER-POWER RESOURCES

This map, prepared by the Federal Power Commission, shows the distribution of the water-power resources of the United States and the extent to which we have developed them. This development is shown by sections whose boundaries are marked by heavy, black lines. Section 1, New England, for example, includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island. The total water-power resources are 55,000,000 horsepower. Areas of circles represent proportional resources of the several sections. Blackened areas of circles show proportion of water power developed

careful investigations and endorsement of the leading hydraulic engineers of the country, to say nothing of the earnest approval of the Secretary of the Department of Commerce. As matters stand today, the Colorado River is a constant peril to the lives and property of the people of the great Imperial Valley. The Boulder Creek Dam, by holding back the vast flood waters of the river, would effectively protect the farming population between itself and the Gulf of California. Furthermore, when this dam, together with similar structures to be erected in the higher reaches of the river, have been built, there will be available a grand total of about 6,000,000 horsepower for the growing needs of the future.

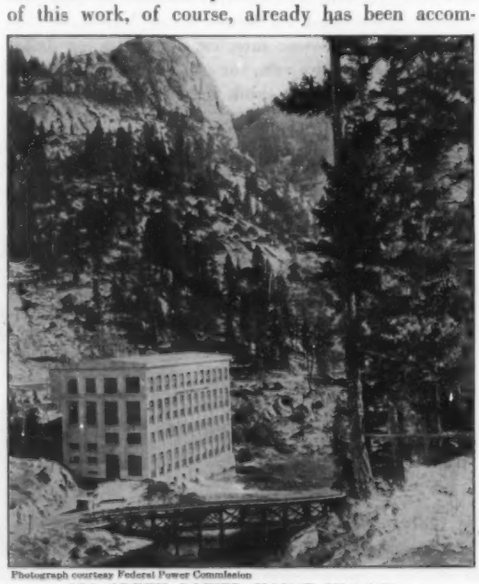
The squabble over Boulder Creek Dam is in the same disreputable class with that other interminable quarrel over the regulation of the Great Lakes, the opening of the St. Lawrence waterway, and the development of the 5,000,000 ultimate horsepower which resides in the waters of that great river.

We Must Take the Large View

Muscle Shoals is another glaring instance of the loss to which the country is subjected by the petty ambitions of the politicians, the jealousies and suspicions of neighboring states and communities, and by the deplorable lack of confidence of the people in the good faith and incorruptibility of its leaders.

The United States is now on the crest of a flood of prosperity which shows no signs of recession. The demand for power is going up by leaps and bounds. There need be no fear lest the development of the potential water powers of the country will exceed the ability of our industries, our public utilities, and our private enterprises, to absorb every kilowatt as soon as it is put upon the wires. We must take the large view and think, not in terms of this or that municipality, or this or that corporation, however powerful, but we must think of the United States as a whole, and view its power requirements, not as those of today, but of the greater future which lies before the country.

The pressing need of the hour is to determine immediately what would be the best system of development for flood control, power development, irrigation and inland navigation of every stream, river and lake that contains promise of usefulness. Much of this work, of course, already has been accomplished; but a vast amount of investigation, survey, et cetera, remains to be done. For the execution of this work, the country is fortunate in possessing in the corps of engineers of the United States Army, a body of men, who, by training and long experience, are well qualified to do this work. Furthermore—and this is a most important consideration in this age of suspicion and distrust—the past record of this body of men has been so honorable and clean, that any report which they turned in would command the confidence of the people—we would like to add the confidence of Congress; but after the recent disgusting exhibition in the Senate, we feel that a reservation has to be made.



Photograph courtesy Federal Power Commission

BIG CREEK POWER HOUSE NUMBER 1

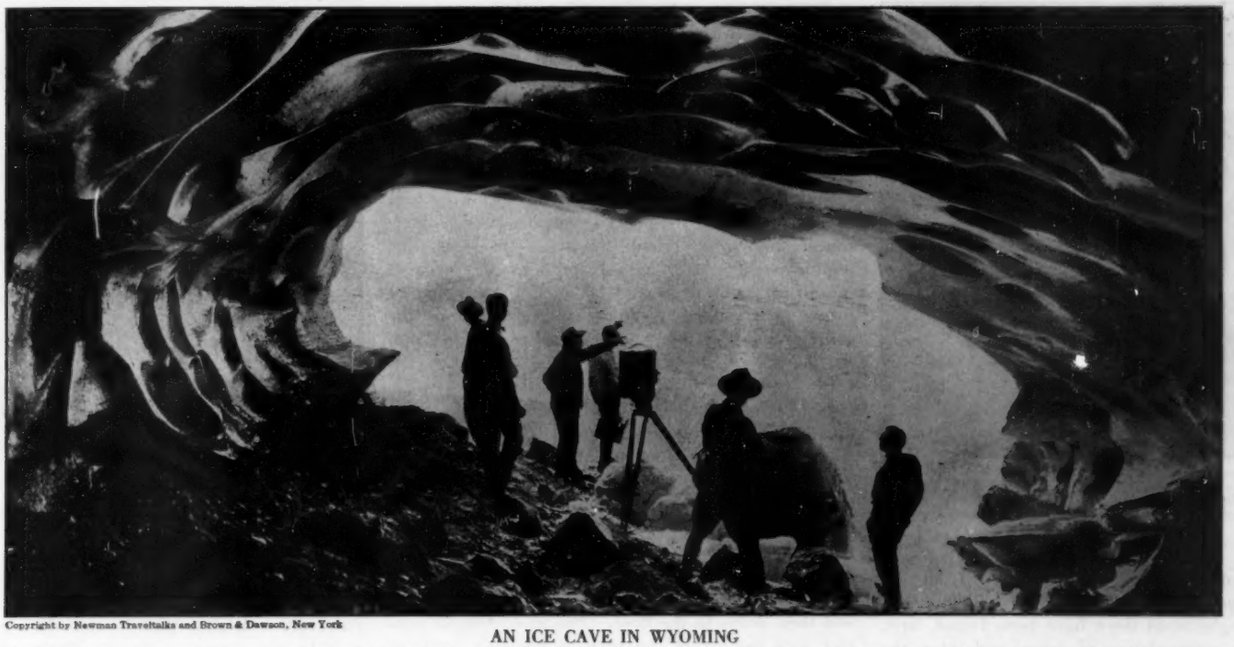
In distant mountain gorges, you come upon fine installations like this one of the Southern California Edison Company

State Rights Will Be Respected

The provisions of the Act quoted above, creating the Federal Power Commission, provides the nation with a body of men who are admirably qualified to carry on a national policy with respect to water powers and federal control. During the five years of their administration, there has been an enormous growth in the development of hydroelectric power.

In spite of much misleading propaganda, it is a fact that the Federal Government has no wish to interfere with state rights as affecting the rivers and lakes of the country. On the contrary, it is keenly alive to these, and its whole policy is directed to an equitable adjustment of the several powers and privileges of the Federal Government, of the various states, and of the thousand and one interests—big and little—that are now making use of, or propose to make use of, the water power of the United States.

¶ *Utilization of our inland water-ways for transportation will be the subject of the next article of this series on conservation.*



AN ICE CAVE IN WYOMING

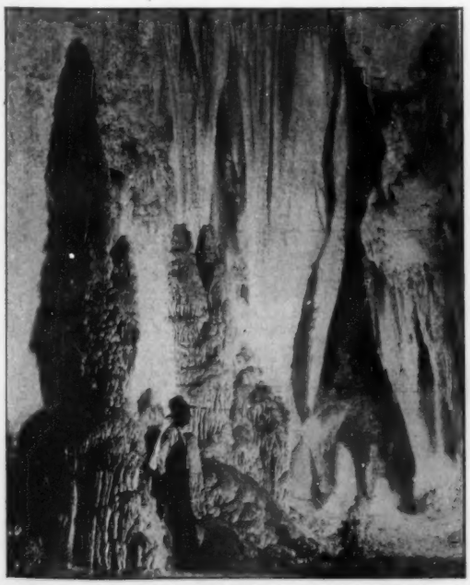
Looking from the mouth of the cave, situated in Huntley Glacier on Mount Moran. This mountain is located in Jackson Hole County, in the Teton range. Ice caves are not rare in this country, being widely distributed and varying greatly in size. The particular cave illustrated is located at a point in the mountside 11,000 feet above sea level. It is possible that this section of country soon may be made part of the national Yellowstone Park

Caves

To Young and Old There Is a Romantic Mystery In Cave Hunting and In the Exploration of Dim, Underground Passageways

By Guy E. Mitchell
United States Geological Survey

WHERE is the boy or man who is not fascinated with the idea of discovering a cave, a hole in the ground, a subterranean passage leading he knows not where and containing he knows not what? Since this is a story about some of the caves in the United States, it may be permitted to put forth the notion that inasmuch as the earliest habitations of man are known to have been caves, there remains in every normal man a latent chord, a throwback to his far-away ancestors that needs only to be touched to awaken a response which might be analyzed as the primeval call to provide a refuge, a place safe and secure from outside intrusion of man or beast, for himself and his family.



"THE COCKSCOMB"

This is the name given to a strangely fluted column in Carlsbad Cavern. The reason for these strange formations is explained in the text

The cave man, as it happens, is not so far removed from our present civilization as we may perhaps think. Tens of thousands of human beings today live in caves, not savages alone, but many of the inhabitants of civilized Europe, enjoying some of the comforts and conveniences of life. Millions of real cave men have not been prehistoric at all. In England, whence many of us can trace our ancestry, a large population inhabited caves long after the Roman invasion, when the Jutes and the Angles and the Saxons crossed over the English Channel and drove the inhabitants of Great Britain westward into Cumberland, Wales, West Somerset, Devon and Cornwall, and into caves for safety.

Where "Tom Sawyer" Roamed

If there is nothing in the cave idea, why is every boy thrilled at the narration of the discovery of a cave in "Swiss Family Robinson," into which the family could retire in safety in case of attack by savages? Why did Jules Verne, in "The Mysterious Island," select a sheer cliff overlooking the sea which the castaways found to be hollow and which they converted into a ready-made dwelling? Or why have Tom Sawyer's cave adventures remained in the mind of every boy who has read this delightful tale of boyhood by Mark Twain? This cave, by the way, is no mere product of the genial humorist's imagination. I have before me a recent letter from the Mayor of Hannibal, Tom Sawyer's and Huckleberry Finn's home, in which he says: "This cave is about a mile and a half south of Hannibal and is open for visitors daily. Vice-President Dawes stopped his special train last fall and visited it. Mark Twain and several of his boyhood companions were lost in the cave for 36 hours and were finally found by a searching party."

The caves of the world give us more indisputable evidence than all other sources combined, of the gradual evolution of the human race—or shall we

"SARACEN'S TENT"

Another fanciful name applied to a weird formation. The human figures in this illustration indicate the enormity of this cavern of Luray

"SPUTTER CONE"

The dying gasp of a volcanic eruption formed this prominence. The entrance to a lava cave in Kilauea Volcano, Hawaii, is also shown here

say advancement instead of evolution—from the crudest savagery down to the days of authentic history. In single caves there have been found, first, under a thin accumulation of debris and litter, the coins and iron weapons of historic man—very recent man of whom we have individual pictures and marble sculptures; next below were found the bronze weapons of an earlier age, and digging down into a still lower stratum disclosed the finely fashioned arrowheads and stone axes of Neolithic man along with his bones and those of the domestic animals which he herded. Still lower down in this history book of Nature have been found the crude implements of the earliest Paleolithic man along with his bones and skulls and those of many extinct animals which he fought, subdued and devoured. The sequence is complete, as far as it goes, back to a very early and ancient type of savage, inferior man.

The caves and caverns of America are many and of several classes. There are fantastic marine caves and grottoes where wave-borne sand and pebbles have carved out deep holes in the shore cliffs—forming caves and then later probably demolishing them. There are remarkable lava caves where the outer shell of the lava flow has hardened and the lava stream beneath has flowed onward in its course, leaving in some places most fantastic formations of molten rock "frozen" in place; and there are also real ice and glacial caves. Then there are occasional caves formed by aeolian erosion where the wind has swept fine sand against soft or damp, crumbly rocks and has cut out openings of various sizes and shapes.

However, most of the great caverns are found in limestone country and are due to the phenomenon of water, charged with carbonic acid gas—carbon dioxide—eating away the limestone. This natural chemical activity not only excavates vast subterranean tunnels and chambers but at the same time populates them with fantastic and in many places beautifully colored natural statuary, the commonest forms of which are stalactites hanging from the ceilings and stalagmites that have grown up from the floors.

Suppose we follow Nature's laboratory process for the moment and see how she creates these two dominant forms of decoration in nearly all limestone caverns. A drop of rainwater sinks into a limestone crack leading to a cavern. Charged with carbonic acid gas from the air, it immediately begins to dissolve the limestone and, soon absorbing a large percentage of carbonate of lime, it creeps along the crack in the limestone until it reaches the roof of the cavern. Here it pauses suspended for a moment and then drops to the floor. But in coming in contact with the air of the cave, it has lost much of its gas and part of it has evaporated; and it cannot carry all the lime that it has absorbed. So as it drops, it leaves a tiny portion of the carbonate of lime on the roof. The next drop to come along likewise deposits a little lime and in the course of time an "icicle," called a stalactite, is built down from the roof, often assuming a weird shape. Some notable examples are illustrated in the various photographs reproduced in these columns.

Thousands of Miles of Caverns

In the same way, as the drop falls to the floor of the cavern, it deposits a portion of its load of lime and there a stalagmite is gradually built up. Eventually these may meet and form a pillar of large dimensions, or they may grow in clusters and coalesce, forming fluted walls of every conceivable variation. If the drops come rapidly, the "icicles" will be rather uniform in shape; if they flow very slowly, so slowly perhaps as not to drop at all, the formations may grow out sidewise into fantastic, flowery looking formations of beautiful or perhaps grotesque design. If the water contains pure carbonate of lime, the deposits will be pure white, but slight impurities may impart to them almost any color.

"DEVIL'S PICTURE FRAME"

This is another cave entrance in the Kilauea Volcano, Hawaii. Here, the cascading molten lava cooled and formed this weird vestibule

Iron oxide in the water, for example, will produce stalactites and stalagmites of nearly every shade of red from a delicate pink to rich deep brown, while a little manganese, as in the Mammoth Cave, will lend to the cave decorations a dark, steely, appearance. A small amount of copper in the water will give to the stalactites and other formations a wonderful light green color.

Some day we may have a census of all the caves of the United States and the aggregate length of their subterranean passages will be a good many thousand miles. But this will be only after a vast amount of additional exploration has been undertaken. It is hardly probable that any large cave has been fully explored. In some of the oldest caverns new and unexpected chambers and galleries are continually being discovered. The well known Endless Caverns of Virginia, discovered a generation ago, are visited by thousands of people every season. Only a few days ago, an Alaskan mountain explorer, who strangely enough concluded to try cavern exploration, told me that he and some others had penetrated back of the known galleries of the Endless Caverns something over a mile, finding a new lake and other attractive things. However, it was the toughest kind of a job as in places he had to crawl on his stomach to get from one chamber to another. He remarked that he was leaving the next day for his dear old Alaska where there was a good deal

"THE SNOW DRIFT" AND "TIGER'S HEAD"

At the left is the white formation that is responsible for the title, "Snow Drift." In the upper part of the picture is an unusual structure of natural origin which resembles greatly the head of a tiger with wide-open jaws

ENTRANCE TO A GLACIAL SNOW CAVE

This cavern is found on the Three Sisters Mountain, in the state of Oregon. This illustration is from a photograph taken in the summer time at an elevation of 10,000 feet above sea level. The snow remains here all year long

more of the outdoors and wide, open spaces available.

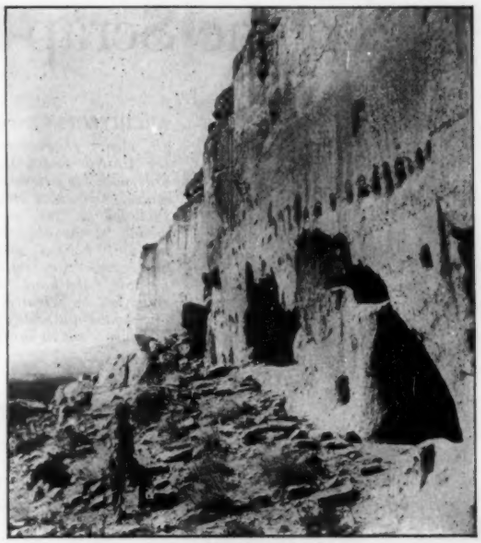
The Mayor of Hannibal, previously mentioned, wrote that last spring another cave had been found quite close to the one in which Tom Sawyer was lost, which is believed to be even larger than that famous one. The Shenandoah Valley of Virginia, in which the Endless Caverns are situated, is a famous limestone country. It was noted for its fine roads of limestone long before the days of "good roads," and it is equally noted for its many picturesque caverns, the best known of which are the Luray Caverns, the Endless Caverns, the Shenandoah Caverns, Weyers Cave and Zircles Cave. The whole valley and the nearby mountains are underlain and honeycombed with caverns, and the country is full of characteristic sink holes down which the rainwater pours to play its part in eating away the not everlasting rock beneath. In many of the caverns the work is progressing actively but in others the caves are high and dry. They have had their day of labor and are now finished masterpieces of Nature's sculpturing.

Curious Contents of Caves

There is probably no great cave the history of whose discovery is not at least tinged with romance. Many of our famous caverns have been found by accident. The Endless Caverns were discovered by some boys and a dog. They were chasing a rabbit which disappeared into a hole. After a little search, this hole was found to lead into the cave. The wonderful Luray Caverns were discovered by a similar accident. There is a story for each cave. Some of these stories are doubtless a bit fanciful. They all improve with age.

Kentucky is another great limestone region where the rock formation is considerably more massive than in the Shenandoah Valley, and consequently the caves are of greater dimensions. The Mammoth Cave alone has ramifications of scores of miles of subterranean passages and lofty chambers. Its area is sufficient to accommodate tens of thousands of people. The blind fish of the Mammoth Cave rivers are one of its curious products. There are a number of species of them. The cave area of Indiana constitutes a region resembling in general that of Kentucky and belonging to the same geologic formation. Rivers emerge from the mouths of several of the larger caves and in some instances turn water wheels.

In Lawrence County alone there is Hamer's Cavern the stream flowing from which fills the floor of the archway so that a boat is needed for exploration; there is Donelson's Cave which also discharges a large stream; Connelly's Cave; Grinstaff's Cave, Campbell's Cave; Dry Cave; Bussard Cave; Shiloh Cave, and Blue Spring Cave. Nearly all of them contain blind animals, niter beds, bats, and Indian relics. One of the finest caverns in Indiana is the Wyandot Cave, and the nearby Little Wyandot. New York has a magnificently decorated cave in Schoharie County—Hawes' Cave—which is likened to the incomparable Luray for the beauty of its alabastine formations. In many of our more spectacular caverns, such as this one, elaborate systems of electric lighting have been introduced which augment the natural marvels.



MAN-MADE CAVES

A portion of the cliff-dweller village of Puye, New Mexico. The village extended along the cliff for half a mile

Briefly to describe even the caves of considerable size in the United States would require several volumes. Even a list of them would be long. Canada also has a long list of important caves, while some of the caves of Mexico and Central America are of international reputation.

Along with the caves of America it is well to mention the mysterious cliff dwellings of the west, which are not, however, real caves but rather are big niches under overhanging rocks, perched high in the face of the cliffs. As to who the cliff dwellers really were, we have little information. There are hundreds of these cliff caves in different parts of the southwest. Another class of interesting early American cave dwellers was a race of prehistoric Indians in New Mexico who laboriously cut out rooms and series of rooms in the sheer walls of the cliffs at a safe distance above the floors of the valleys, reaching them by ladders. These were communal Indians and some of the canyon walls contain hundreds of these man-made caves.

How Carlsbad Cavern Was Discovered

Having taken only a casual glimpse of the caves and caverns of America, we must not forget the recently discovered wonderful Carlsbad Cavern in the Guadaloupe Mountains of New Mexico which was described in the Scientific American of December, 1923. This cave was discovered by deer hunters over twenty years ago, due to the swarms of bats that issued from its opening in the evenings. However, very little was known about it until Willis T. Lee, geologist of the United States Geological Survey rediscovered and described it as being the most gigantic cavern in America and probably in the world. More recent explorations conducted by Dr. Lee under the auspices of the National Geographic Society have confirmed his first descriptions, in that the chambers and galleries and stalactites and stalagmites are of unusual size.

Where dimensions are measured in feet in ordinary caverns, they may be measured by yards if not rods in this wonderful cavern. One room is 349 feet high and half a mile long, large enough, as he states, to set the huge pile of the Capitol Building at Washington in a corner, and lose it. Yet the glistening onyx decorations and the natural statuary are as fine as in any cave he has ever seen, even Luray, which in all the older cavern descriptions seems to be given the palm for beauty of decoration.

The interbedding of soluble gypsum with the limestone seems to account for the immensity of the Carlsbad Cavern. But yet more interesting, Dr. Lee says that the massive limestone pile of the Guadaloupe Mountains, rising over 10,000 feet above sea level, is filled with caverns, and he believes the range includes a cluster of caverns doubtless surpassing anything in existence. Human skeletons have been found in some of these caverns, while many new species of cavern fauna have also been discovered. The wild, Yosemite-like canyons of the Guadaloupe Mountains, he says, with their many yawning cavern mouths, await the hardy explorer and will spell for him opportunity for many years to come before all their secrets are disclosed.

IN THE CAVERNS OF LURAY

The "Frozen Fountain" is an interesting example of the forms which stalactites and stalagmites take. The origin of the name is obvious from this photograph

IN THE CARLSBAD CAVERN

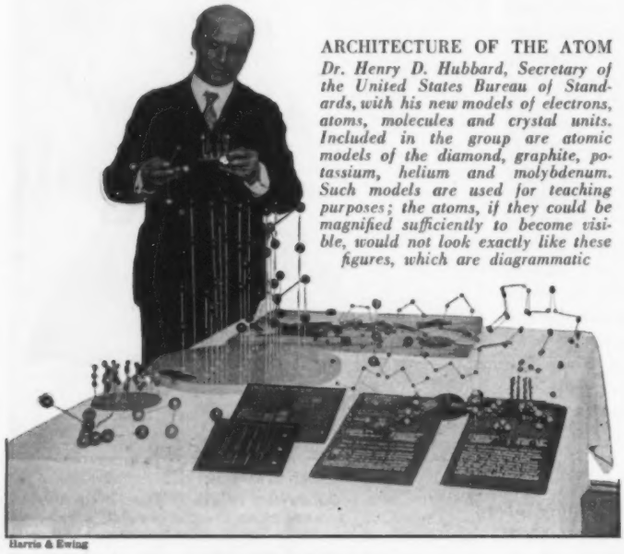
Stalactites are the chief attractions in this particular part of the famous New Mexican cave. Note the smaller stalagmites "growing" up from the cavern's floor

From the Scrap-book of Science—Came

Wide World

SHOTGUN SHOOTS ANESTHETIC NEEDLE

Instead of killing animals with bullets, Captain Barrett W. Harris of the Field Museum, Chicago, shoots them with an anesthetic, putting them to sleep without permanent injury. Capture is then easy. The syringe and needle which supply the anesthetic are fired from an ordinary shotgun



Harris & Ewing

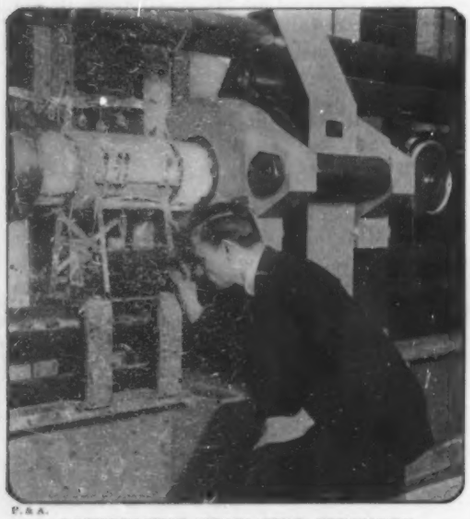
ARCHITECTURE OF THE ATOM

Dr. Henry D. Hubbard, Secretary of the United States Bureau of Standards, with his new models of electrons, atoms, molecules and crystal units. Included in the group are atomic models of the diamond, graphite, potassium, helium and molybdenum. Such models are used for teaching purposes; the atoms, if they could be magnified sufficiently to become visible, would not look exactly like these figures, which are diagrammatic

P. & A.

MORE SAFETY FOR RAILROAD

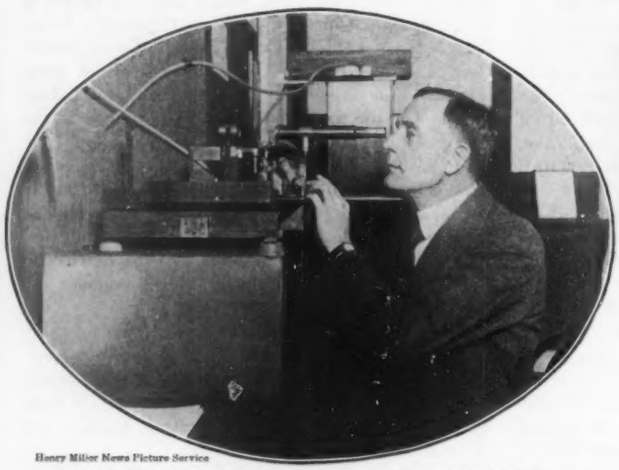
When a slide occurs on the Southern Pacific Railroad, cially constructed fence. This automatically sets the se which might otherwise enter the block and be derail



P. & A.

GOVERNMENT TESTS FIRE STRENGTH

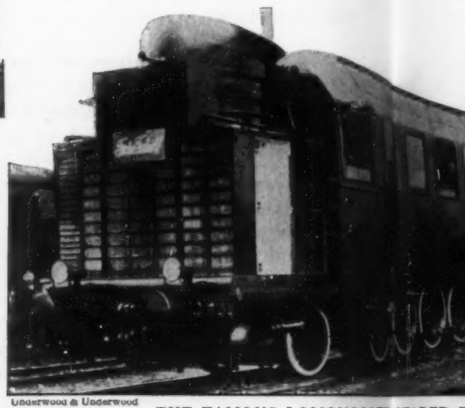
At the United States Bureau of Standards compression tests have recently been made on steel columns at temperatures to which they are likely to be submitted during fires. The deformation of the specimen under high pressure in a testing machine is here being observed



Henry Miller News Picture Service

FAMOUS ASTRONOMER STUDIES SPECTRAL LINES

Dr. Edwin S. Hubble, of the Mt. Wilson Observatory, has devoted his recent years to work on many astronomical problems which also happen to provide excellent and striking newspaper stories. Therefore a photograph of him will interest our readers. Recently he announced a new estimate of the distance to which the world's most powerful telescope can photograph star images—800,000,000,000,000,000,000 miles!



Underwood & Underwood

THE FAMOUS LOMONOSOFF GEARED I

In Europe, the relatively high cost of fuel has brought about mu to efficiency rather than first cost and weight. This is one recei sor Lomonosoff and built in Germany, it has been running in a Diesel engines develop 1,200 ho

P. & A.

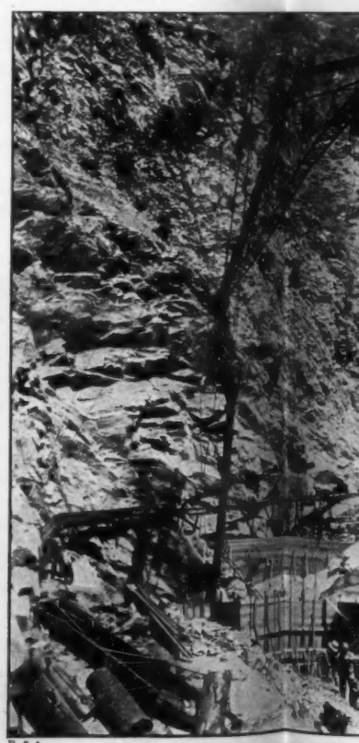
PLAYS COLOR-PIANO

Leo Gaesland with the electrical apparatus of his recently invented color-piano which synchronizes color effects with orchestral music, thus giving unusual results

P. & A.

"FINGER-PRINTING" BABY'S FEET

A great deal of future trouble would be saved if all hospitals were to keep such records of infants. In the illustration, a single sheet of paper bears the finger-prints of the mother and the footprints of her baby. Footprints are as distinctive and permanent in pattern as finger-prints. Senator Copeland is shown examining the prints

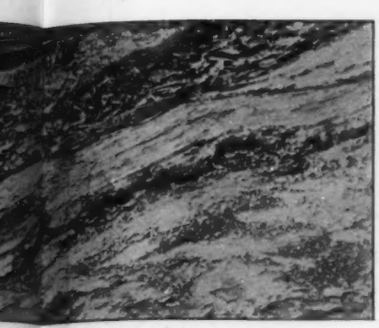


P. & A.

BEGINNING WORK ON HIG

Pacoima Dam near San Fernando, California, is o Los Angeles' flood-control projects. Flood wate mountains and run off slowly after flood conditi reach a level 359 feet above the stream. Note cha

-Camera Shots of Scientific Happenings



FOR RAILROAD TRAVELERS

rn Pacific Railroad, it breaks electric wires in a spe- matically sets the semaphore signal against any trains block and be derailed. Above: a practical try-out

OSOFF GEARED DIESEL LOCOMOTIVE

as brought about much recent study of locomotives with an eye . This is one recent type of locomotive. Designed by Profes- been running in and out of Moscow for several months. Its nes develop 1,200 horsepower

G WORK ON HIGH DAM

do, California, is one of the most important of jects. Flood water will be held back in the after flood conditions subside. This dam will e stream. Note chutes for distributing concrete

FAMOUS GEODESIST TESTS RADIO-CHRONOGRAPH

Dr. William Bowie, of the United States Coast and Geodetic Survey, is Director of the Division of Geodesy. Here he is shown with radio apparatus used for accurate determinations of longitude. Dr. Bowie has charge of the precise surveying by which distances of a hundred miles are determined within an error of less than one inch; he recently triangulated the line in California by which Prof. Michelson redetermined the velocity of light, as described in a recent issue of the Scientific American

P. & A.

Wide World

EDISON'S FLORIDA RUBBER ESTATE

Here is a photograph of some of the "Madagascar" rubber plants about which the newspapers have had much to say since it was discovered that Thomas A. Edison was experimenting with them. In the last analysis, the question of growing rubber in the United States depends on finding a way to make machinery do most of the work and thus compete with cheap Oriental labor obtainable where rubber is now grown

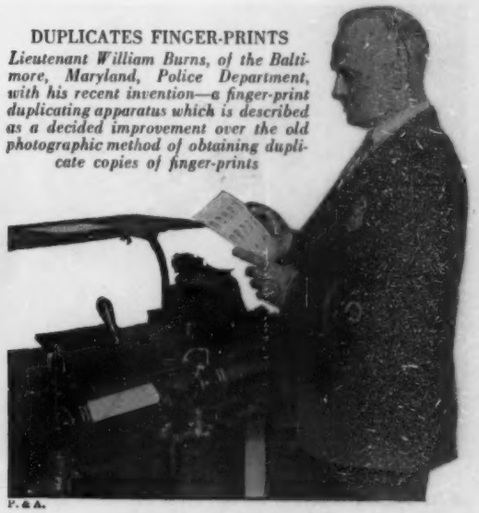
P. & A.

PHOTOGRAPHIC "CANNON" FOR AIRPLANE MAPPING

For photographing distant objects from airplanes, cameras having large lenses are used. This lens measures about eight inches in diameter. The camera was perfected by Lieut. George W. Goddard, United States Army Air Corps, who stands in the cockpit. On the right is a hinged streamline shield for the camera

DUPLICATES FINGER-PRINTS

Lieutenant William Burns, of the Baltimore, Maryland, Police Department, with his recent invention—a finger-print duplicating apparatus which is described as a decided improvement over the old photographic method of obtaining duplicate copies of finger-prints



P. & A.

Wide World

ULTRA-VIOLET RAYS STERILIZE WATER

This is a small sterilizer equipped with a quartz mercury lamp which emits ultra-violet light of the shorter wavelengths. These rays will kill bacteria

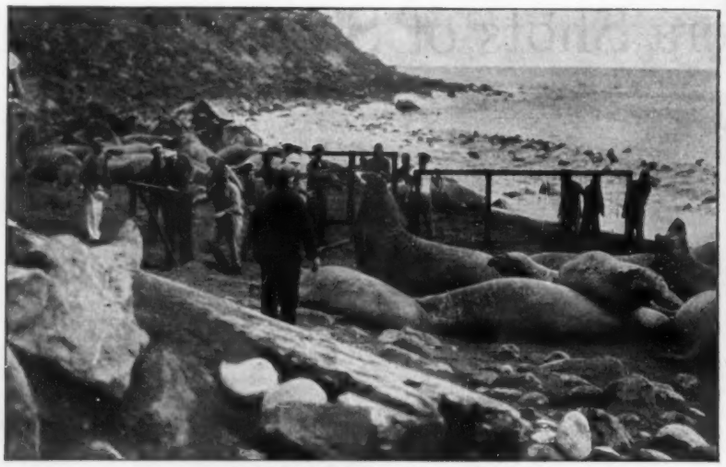
Wide World

MEASURING BODY ENERGY

At Birmingham University, England, studies are being made on the body metabolism of coal miners, under working conditions. Photograph shows apparatus used

IT LOOKS LIKE A BIG JOB

A few of the members of the San Diego expedition sizing up the big bull sea elephant prior to trying to induce him to enter one of the cages provided



FENCING IN A LARGE BULL

This shows how the sections of strong fence were manipulated in an endeavor to segregate one of the animals from the rest without encountering danger

Sea Elephants Preserved for Posterity

These Ungainly Denizens of the Southwestern Coast of North America Have Been Nearly Exterminated, But Are Now Being Protected

By John L. Von Blon

SOUTHERN California's sea elephants, the only species in the Northern Hemisphere, and among the rarest and strangest animals extant, are not only making a last stand but staging a dramatic come-back that will surprise and delight scientists throughout the world. This is the discovery just made by the San Diego Zoological Society, which sent out an unique expedition and captured several of the animals for its pool situated in Balboa Park.

Practically exterminated by ruthless slaughter for the almighty dollar of commerce and given up more than 50 years ago as doomed to extinction, these huge amphibians dwindled to a pitiful few but did not perish. Today, near the very shore where they once basked by thousands, the remnant of the legion is securely entrenched and increasing to such extent that permanent preservation seems inevitable.

Sea Elephant Almost Drowned

The haven of the sea elephants is the Mexican island of Guadalupe, where the Republic of Mexico aims to safeguard them. The United States has pledged her moral support to further the laudable endeavor. It is a cause in which this country should have a deeper interest than any other since the sea elephants' home was formerly here. They ranged from Cape San Lazaro, above Magdalena Bay, Lower California, north to Cape Reyes, near San Francisco, almost a thousand miles, but were most numerous along the Southern California coast and on the Santa Barbara Channel Islands.

With a permit from the Mexican government and the valuable cooperation of the United States Navy, which granted the use of *Eagle Patrol Boat Number 34* for the purpose, and comprising about twenty men, the San Diego expedition was well equipped. Lieutenant E. W. Dort, Naval Reserve officer, was in charge.

Sections of strong, knock-down cages made of heavy wire and timber were taken ashore in small boats and by dint of much maneuvering, "fences" were thrown around groups of the ungainly creatures, which lay about by scores, while even more remained in the water. Those particularly selected were segregated with difficulty, nobody being eager to approach within striking distance. These were a two-ton bull 14 feet long and two cows of 11 and 10 feet in length, weighing about 1,500 pounds each. Although sluggish and slow of motion they were extremely hard to manage, bulk alone being a formidable drawback.

These elephant-trunked seals show scarcely any fear of humans and make no effort to get away, the males even displaying some ferocity. Hence

FENCED IN!

The old bull has been separated from the rest of the herd and will soon be lodged safely in his cage

it was a precarious task to noose the old bull and roll him into the improvised pen. He resisted forcefully when the last segment was being lashed in position and severely lacerated one man's arm and shoulder.

The strength of the entire company was required finally to gently fix the angry brute in the portable floating prison and tow him out to the ship. In the struggle through the rough and treacherous surging brine, every sinew was exerted to the utmost, tugging, lifting, pushing and rowing. There was no crane on the vessel and so the cumbersome, shifting burden had to be hoisted aboard with davits, a method far from satisfactory. Twice the pen dropped back into the water but each time it was quickly recovered and at last placed right side up on the deck.

Although carefully handled, the bull underwent an ordeal that might have ended his career. The towing cages were about 20 feet long by five feet wide and high, with solid plank floors, and therefore somewhat unwieldy. Empty iron casks were employed as buoys to keep them afloat but broke away in this instance with the result that the bull went under too often and was nearly drowned before reaching the transport, although he is a water denizen as well as of the land. However, no ill effects followed. The females were more easily taken away and started on the northward voyage.

Will Not Eat Live Fish

In due course they reached the San Diego Zoo and are now in splendid condition. The clime is that to which they belong. At first, forced feeding had to be resorted to but now the trio feels at home and daily consumes 120 pounds of killed fish, rejecting live ones. An oily mackerel type, abundant in local waters, is preferred and the zoo constantly keeps three tons in cold storage against an off season.

Dr. Harry Wegeforth, president of the San Diego Zoological Society, planned the expedition but did not accompany it. The San Diego Museum of Natural History, Professor Laurence M. Huey curator, encouraged the undertaking in every way. Lieutenant Dort had made previous trips to the isolated island. Two years ago, with virtually the same party, he captured a sea elephant and presented it to Mexico City. It soon expired there, probably because of the altitude and different climate. On another occasion a young bull was taken, which still thrives in Balboa Park.

Guadalupe Island, the last stand of the sea elephants, is a frowning height rising out of the Pacific to an elevation of 4,523 feet. It is 21 miles long, 140 miles off the coast of northern Lower California, and approximately 250 miles south of San Diego. Uninhabited, unfrequented, barren and drear, surrounded by deep water and hemmed by

a thundering white surf, it has a forbidding aspect that holds peculiar appeal for venturesome lovers of desolation after once they glimpse it.

On the northwest side, where the rookery is located, the island is a series of sheer, utterly impassable precipices reaching three-quarters of a mile heavenward, but sloping gradually to the opposite shore. Under these tremendous cliffs, and flanked by others which extend into the ocean, accessible only from the sea and further protected by heavy breakers that usually roll high, Elephant Beach is indeed a natural sanctuary—a secluded strip of fine sand 350 yards long and 30 yards wide with plenty of afternoon sun. Landing has its perils.

The San Diego expedition had a good opportunity to make a fairly accurate count of the herd and found it to consist of 450. In 1912, Charles Haskins Townsend, director of the New York Aquarium, who had gone to the island after specimens, which lived but a short time in the east, carefully estimated the number at 150. This growth in the intervening years, coupled with the commendable announcement of Mexican officials that no further permits to take any will be issued, appears to guarantee a long future for the species. Molestation will incur penalties.

Tame Goats and Cats Gone Wild

Probably no other isle has as weird an animal population as Guadalupe, even disregarding the sea elephants. Fifty thousand wild goats, the progeny of tame ruminants introduced there in other centuries by early Spanish explorers, roam the rocky fastness and keep the landscape closely cropped with their sharp teeth. Immense numbers annually succumb to starvation and kids take their places for a season or two.

Some years ago whalers abandoned a few cats, possibly ships' mascots that strayed ashore, and these, too, have increased to not less than 50,000—domestic felines turned desperately savage and still multiplying. The goats consume all the vegetation and the cats have eaten all the birds, and thus a place that might otherwise be a paradise is a songless desert, without grass, shrubbery or plumage. What the cats prey upon now that the feathered life is gone and how they manage to eke out an existence are profound mysteries worthy of investigation. On the summit, above the 4,200-feet altitude line, is an extensive growth of beautiful live oaks. These have been stripped of bark and low-hanging boughs by the hungry flocks of goats.

The sea elephant, a true seal, derives its name from its gigantic size and the extraordinary snout or trunk developed by the male. *Macrorhinus angustirostris* designates our northern species. The southern, also decimated to the danger point, is *M. leoninus*. The bull attains a length far exceeding that of the land elephant, there being records of animals measuring 22 feet, with a girth of 12 feet just behind the fore flippers; and reports, perhaps fanciful, of others 25 and even 30 feet long with corresponding circumference! There is an authentic account of an 18-footer taken by the brig *Mary Helen* in 1852 on Santa Barbara Island, less than 50 miles from Los Angeles as the crow flies. He yielded 210 gallons of oil, superior to that of the whale as a lubricant. The female is only one-third the size of the bull and has no proboscis, the nose merely projecting somewhat over the mouth.

LOOKING THEM OVER

One of the bulls, showing the trunk-like nose and the thickened skin protecting the throat

Ponderous and awkward, the beasts nevertheless roam considerably, sometimes climbing 50 or 60 feet above water on broken ground. When excited to inordinate action they travel rapidly. When moving of their own accord they arch the body like an inch-worm, draw the hind quarters well forward with the belly lifted from the ground, and then shift the forequarters with the front flippers spread outward. In landing they spread the hind flippers to get the carrying benefit of every wave. When settling to rest, both old and young cover themselves partially with sand, tossing it over their backs with the front flippers, each of which has five nails shaped somewhat like those of the human hand but dull black and up to two inches long. The posterior flippers are clawless.

The adults are yellowish brown, with thin, patchy, short hair. After shedding they assume the bluish cast of the land monster for which they are named. On each side of the face are whiskers consisting of 30 to 50 hairs seven or eight inches long, spirally twisted, and dark brown, tipped with a lighter shade. There are no external ears. The eyes are extremely large and lustrous, like those of nocturnal animals, suggesting that the creatures may be more alert by night than by day. Newly-born pups are black and literally too fat to move, while yearlings are grayish brown and active. The latter emit a scream like that of the peacock. The breeding season at Guadalupe begins just before March 1 and the period of gestation is one year.

The proboscis is thick and heavy, about as wide as the space between the eyes and sometimes as long as 18 inches from tip to eye. The trunk is flaccid and pendent when the animal is crawling, and when sleeping it rests on the sand in a shapeless mass. It is broad and fleshy to the tip where the nostrils are placed, the nasal openings being wide apart and directed slightly downward and outward. The trunk sometimes relaxes until it hangs into the open mouth when the head is turned up, and it may even hang to the rear.

Hunting Sea Elephants *Was* Profitable

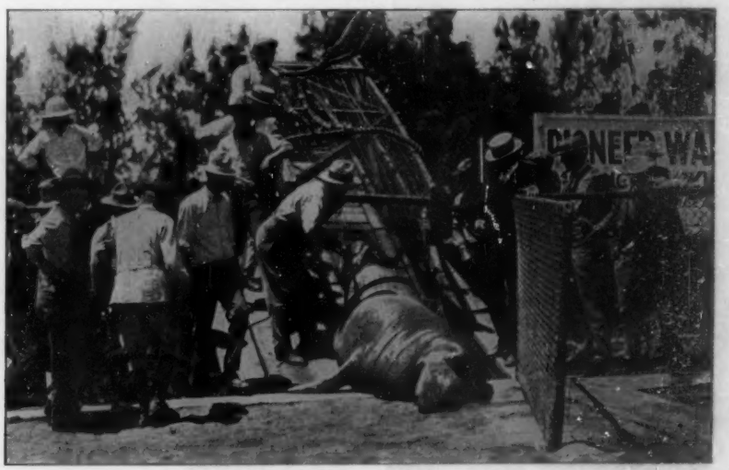
The canines form massive tusks, ugly in combat, and much used. The reigning bulls and the "bachelors" fight furiously, sometimes for a dozen cows. Crawling slowly within reach, they rear on their front flippers, draw the heavy proboscis into wrinkled folds well up out of the way, roar and snort and strike at each other's necks, inflicting deep gashes. The skin of the under part of the neck and fore part of the breast is thickened and practically hairless. The surface is rough and calloused by years of such clashing. It forms a shield extending from the throat just below the base of the jaws to the level of the flippers and over half way back on each side of the neck and breast.

The hide, fully equal in average thickness to that of the largest bullock, was valuable for harness-making and similar uses and accordingly profitable to hunters, generally from vessels primarily engaged in pursuit of the gray whale common and abundant in these waters.

Such are the amazing dwellers that were on the verge of vanishing and now are returning to us. Speared and clubbed to death for the money they would bring, and unable to avoid the blows and blades of those who sought them out, theirs was a narrow escape. The San Diego Zoological Society has performed a signal service in bringing to the world the word of their revival.

LAUNCHING ONE OF THE CAGES

Getting the animals from the shore to the Eagle Patrol Boat Number 25 *required hard work on the part of the entire crew, and not a little danger to life and limb*



A NEW RESIDENT FOR THE ZOO

One of the huge, ungainly sea elephants being urged from his temporary cage to his future and permanent quarters, where he will be one of the important exhibits

Novel Devices for the Shop and the Home

A Department Devoted to Recently Invented Mechanical and Household Appliances

Conducted by Albert A. Hopkins

Carrying the pack

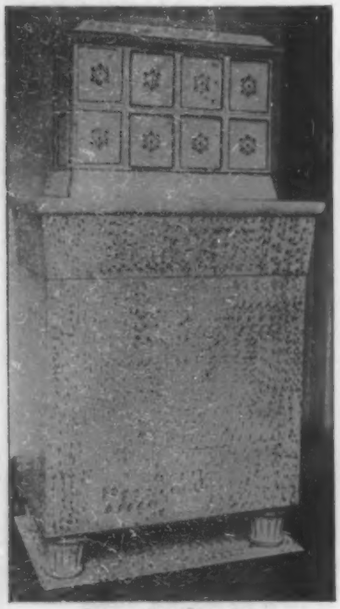
Bed-Tent Pack

A HANDY camper's pack weighing only 43 pounds is shown at the top of this page. It carries the bed, tent and cooking utensils. The hammock or bed is swung between the two tent poles, thus being kept off the ground. The poles are jointed and fit into pockets on each side of the pack.

Piston and aluminum cylinder

Mechanical Football Game

IN the lower center of this page we illustrate a miniature football game. In it there are two teams of eleven mechanical figures each. Two people play; each controlling, with a lever, the figures of one team. Every "man" on the teams has a movable leg. When the lever is depressed, ten "men" kick and one "man" is moved across the goal line in an attempt to prevent a score. The ball always comes to rest in a depression at the movable foot of a figure and so is always ready for play.

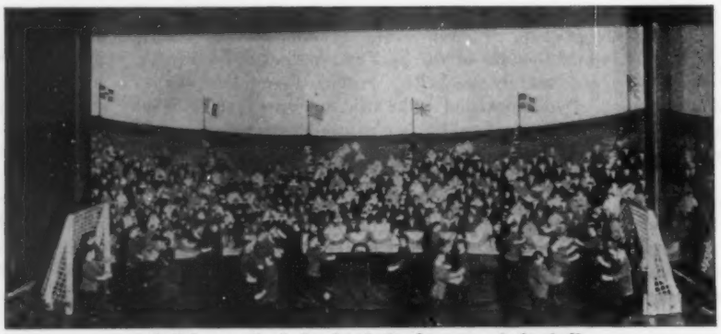


Decorative glass stove

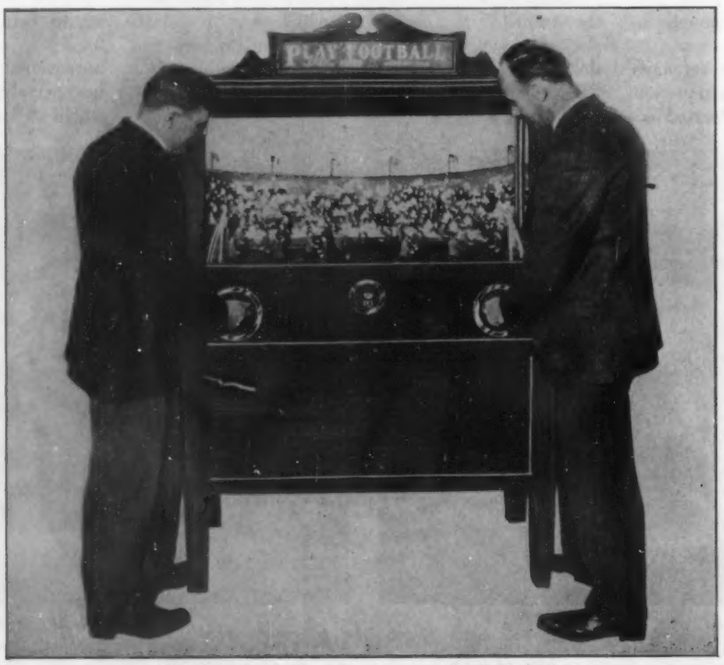
The hammock is kept off the ground and is covered

Modern Glass Stoves

THE illustration in the lower left-hand corner shows a modern stove made of ivory-colored glass, with painted blue designs. These stoves are being adopted by German housewives.



A "close-up" of the football players and the ball

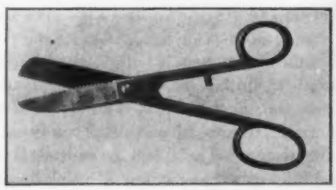


Playing football with a new mechanical device

End view of the tent

Unlined Aluminum Cylinders for Air-Cooled Motor

A NEW idea in air-cooled motor construction is now being tried out in England. In order to obtain greater heat dissipation than has yet been possible, the inventor of this engine has made the cylinders of an aluminum alloy. These are not lined with steel, but the armored piston illustrated runs directly in the aluminum cylinder.



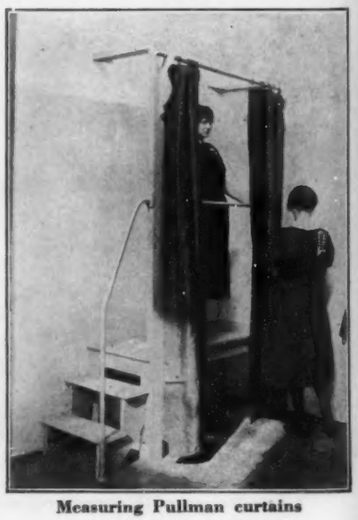
Belt cutting made easy

Belt-Cutting Shears

ONE of the cutting blades of the shears illustrated is furnished with teeth which are inclined toward the handle. These teeth serve to prevent the material from slipping.

Safety in the Curtain Shop

THE Pullman Company regards the safety of their employees as of great importance. In their curtain shop they have a measuring and draping platform which does away with the use of dangerous stools.



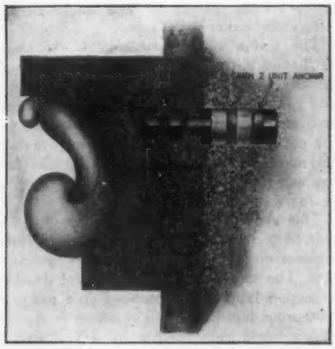
Measuring Pullman curtains

Expanding the soft lead to form a firm and strong anchorage

Anchors for Use in Concrete

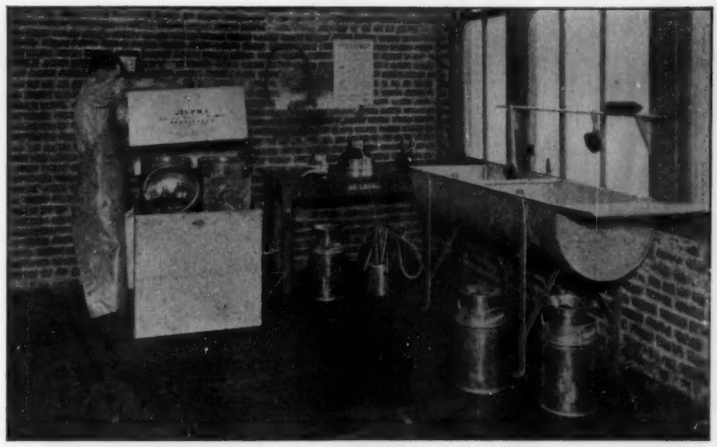
THE problem of fastening structural and ornamental fixtures to concrete, brick and other building materials, has always presented considerable difficulties, particularly where the work was large, or the load was heavy. Molten lead, sheet packing, lead shields and expansion bolts all have their uses, but the device which we illustrate on this page affords a very simple and inexpensive method of obtaining a strong anchorage.

With the so-called "cinch" type of expansion, a relatively soft lead composition expansion member is forced against the



Anchoring a terra cotta cornice

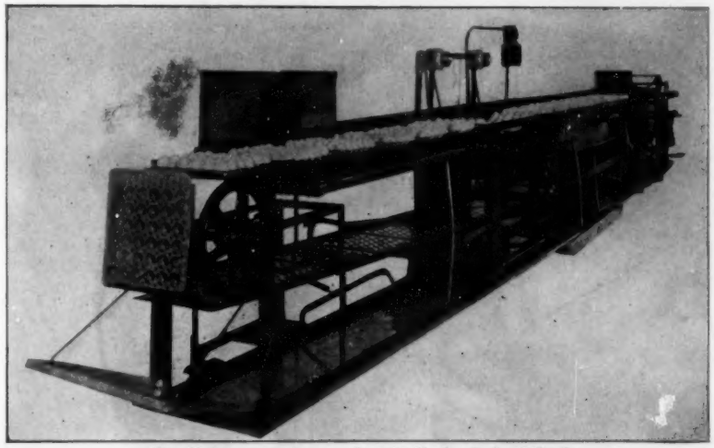
cylindrical surface of the hole by the compression of a malleable-iron conical wedge. This procedure fills up all irregularities in the surface without fracturing the masonry or concrete, and gives a secure anchorage. Our illustrations show a two and a three-unit bolt being secured by expanding the lead with the aid of a hammer and a special tool. The illustrations in the left and right center of this page show application of these anchorages and are self-explanatory.



An electric sterilizer for dairy use

Preserving Eggs by Oil Bath

IN the apparatus shown in the center of this page, the eggs to be sterilized and preserved are carried on an endless belt through an oil bath at a temperature of 235 degrees, Fahrenheit. The oil fills the pores in the egg shell and prevents air from entering. Close regulation of the heat is obtainable by using electricity for generating the heat and for controlling the temperature.



Sterilizing eggs in an electrically heated oil bath

Folding Boat Carried on Trailer

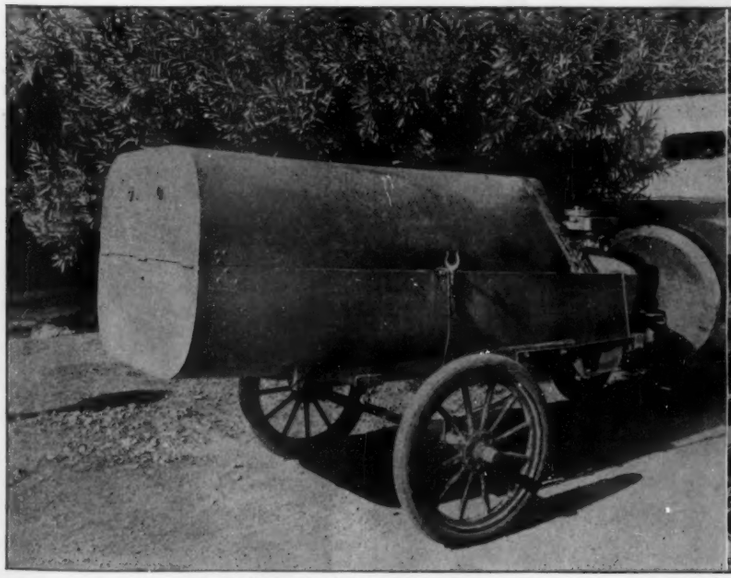
THE boat shown in the illustrations at the bottom of this page, is constructed of white-cedar strips attached to an oak frame. The boat is 15 feet long. In the folded position, the hull rests in a cradle body shaped to fit the contour of the boat. The hull is fastened to the cradle by clamps. The cradle is then mounted upon a pair of trailer wheels equipped with pneumatic tires. So secured, the boat is transported overland behind an automobile, providing a safe and commodious trailer body for the carrying of clothing, bedding, tents, luggage, et cetera. Arrived at the water's edge, the prow end is unfolded and secured in the open position.

A three-unit anchorage being put in place in a concrete wall

Electric Sterilizer with Thermostatic Control

A NEW type of electric sterilizer that begins to heat immediately when the current is turned on, is shown at the upper center of this page. It will heat 12 gallons of water to 125 degrees in 20 minutes, whereas for sterilizing, it will heat water in the bottom of one compartment to 170 degrees in about 10 minutes. A thermostatic control automatically shuts off the current at a predetermined temperature. This sterilizer is for dairy use. A five-kilowatt double helical heating element is used.

Mooring post needs heavy anchorage



The hull of the folded boat on a trailer

The prow end partially unfolded for use

Powder puff collapsed

Disappearing Powder Puff

A FULL-SIZED powder puff of fluffy texture is carried in the tube shown in the upper left and right-hand illustrations. The puff is concealed completely within the tube by pulling the lower part and adjusting the top cover. In opening, the device is manipulated much like an umbrella. The puff has small wire ribs that support it when fully extended.

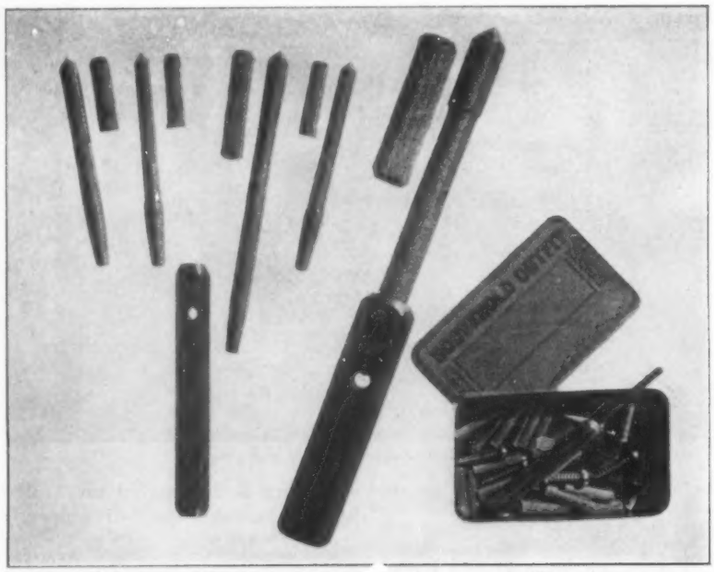
Simple Screw Anchors

WE illustrate at the top and center of this page a simple form of screw anchor called the "rawlplug." These hold screws fast in any material. The smaller sizes are particularly adapted for household use. The drill furnished with the plugs will even cut tile. The plugs are made from longitudinal strands of tough jute fibre. Our upper illustration shows various sizes of drills. The smallest size can be worked by hand; the larger sizes fit in a bit brace. The diameter of plug, hole and screw are virtually the same. As soon as the screw enters the plug, it begins to separate the longitudinal strands of jute fiber, expanding them in all directions and compressing them against the sides of the hole to such an extent that a vise-like grip results. Compressed against the side of the hole, the entire plug becomes virtually an integral part of the material which surrounds it. The screw presses rather than cuts its thread into the plug. In doing so, it forces the minute fibers of the plug into all interstices of the hole. Any direct pull on the screw puts the jute fibers under tension, thus fully utilizing one of the principal advantages of jute—its tensile strength. The fact that the thread is pressed into the plug by the screw permits withdrawal and replacement of the screw as often as desired without affecting the holding power of the plug.

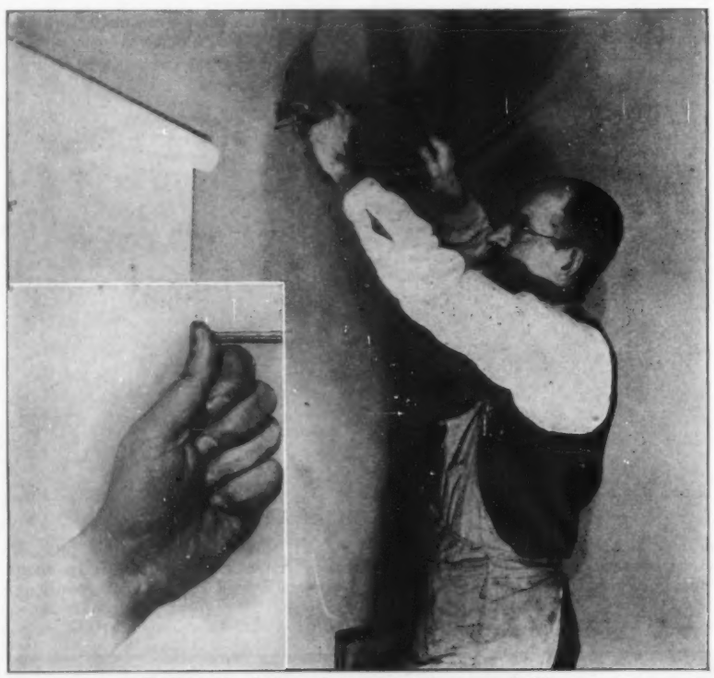
Spring-Skate for Children

A NEW spring-skate for the amusement of children is shown at the bottom of this page. The foot pieces of the skates are mounted upon strong springs. The harder the spring is forced down, the higher the rebound. These skates are said to provide good exercise for children. At least they should have a tendency to aid the child in learning to preserve his or her balance under varying conditions.

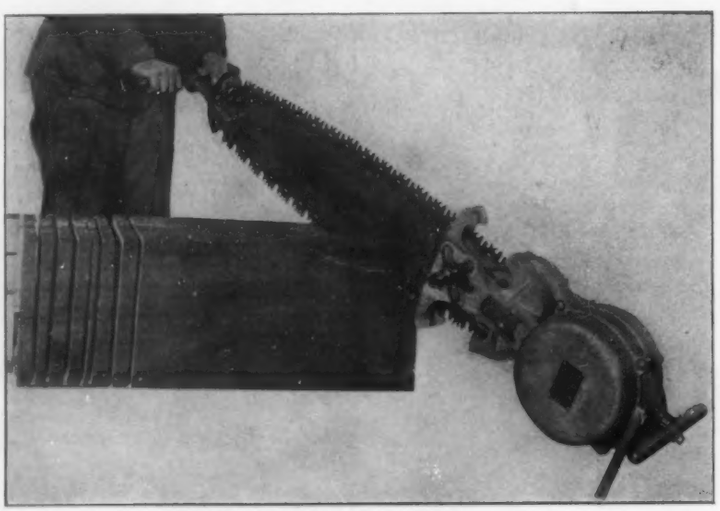
Spring-skates provide action



Drills for making holes for inserting jute screw-holding plugs



Drilling the hole and inserting the screw holder



An electrically-driven timber saw

A "shaving-brush" effect

A Portable Sawing Machine

A DURABLE machine for cross-cut work, enabling two men to do as much as seven or eight with hand cross-cut saws, is illustrated at the bottom of this page. The frame is made of four pieces of selected saw steel, heat-treated to insure long life and rigidly assembled by electric welding. The filler piece, which is smaller than the outside plates, forms a channel around the edge of the frame in which the saw-links travel, thus assuring straight-line cutting.

Four steel guide-pins, a shaft and two spiders (one on each side of the machine), connect the saw frame to the drive-end. The four guide-pins hold the frame in positive alignment and the shaft and spiders clamp it rigidly to the motive end. The saw-links are made of individual pieces consisting of raker and cutter-links, link-pins and bushings. The cutters are held firmly in alignment by the pins and bushings and the latter act as spacers as well as pivots on which the raker-links turn.

The action of the saw-links is the same as that of a rigid saw and all possibility of buckling is eliminated, because the rakers and cutters act in opposition to each other and offset buckling tendencies. Links on the cutting side of the machine travel toward the motor, thus always keeping the machine against the work and eliminating dogging or fastening.

This electrical apparatus operates on 220-volt, 60-cycle, 3-phase alternating current from a power circuit or a portable motor-generator set. The motor is of a simple and durable induction type and is enclosed in a two-part dust-proof housing. The machine is started and stopped conveniently by a foot switch which is housed in a casting of aluminum and copper composition. A three-point reversible plug permits reversing the motor and the cutting direction of the saw teeth, thus equalizing the wear and reducing the frequency of filing.

This saw can be used for trimming timber, for it cuts to the line. It can be used for cutting pulp wood and for cutting posts and mine props. It is valuable for slotting planks and timber. Timber can be piled and cut as a solid block. The saw continuously holds the machine against the work sufficiently so that no dogging or fastening is necessary; this system would be impossible with a cross-cut saw on account of the reciprocating action of such saws.

Details of the spring-skates

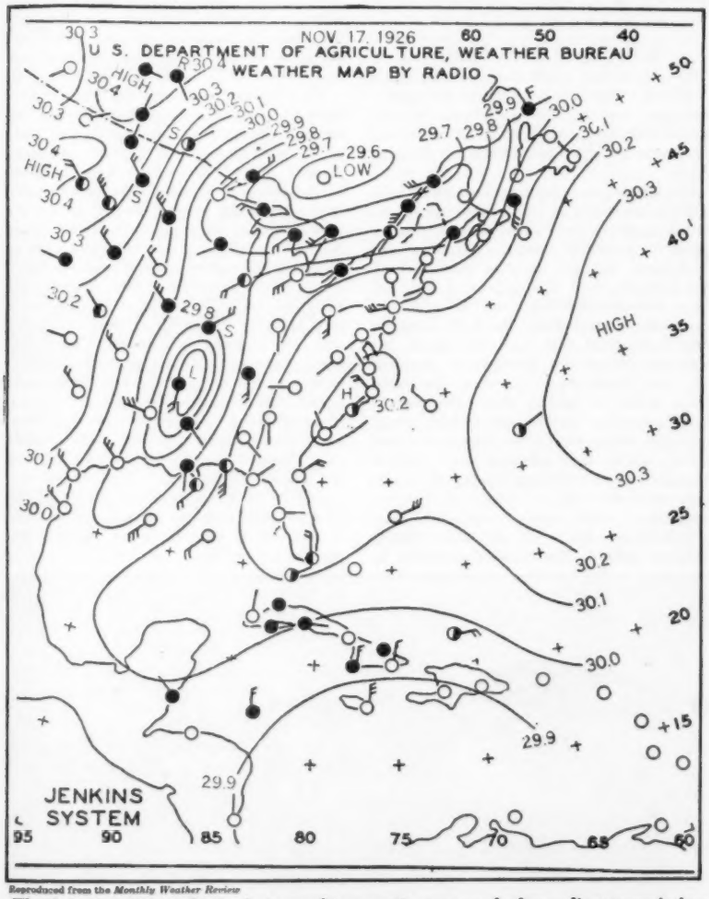
The Scientific American Digest

A Review of the Newest Developments in Science, Industry and Engineering

Conducted by Albert G. Ingalls

Weather Maps by Radio

"THE possibility of using radio for transmitting weather maps by the system to be described is based on the fact that C. Francis Jenkins, its inventor, had already transmitted pictures, writing, et cetera, by his 'television' method. This method appeared to hold great possibilities for the Weather Bureau," says Mr. B. Francis Wood, in the *Monthly Weather Review* published at Washington, D. C., by the United States Weather Bureau. "If pictures could be sent, why not weather maps? Acting on this idea, E. B. Calvert, chief of the Forecast Division of the Bureau, suggested a conference, at which Mr. Jenkins's invention was inspected and its possibilities as a transmitter of weather maps discussed. In August, 1926, the Navy Department cooperating, a special weather map was taken to the Arlington Radio Station, whence it was radioed to the Weather Bureau with remarkably good reproduction.



Reproduced from the *Monthly Weather Review*

Weather map from which photographic negative was made for radio transmission

"In order that extensive tests might be conducted, the Navy Department not only generously loaned the services of its most powerful transmitter at Arlington, operating on 8,300 meters and using from 20 to 40 kilowatts, but it also conducted reception tests aboard the *U. S. S. Kittery* and the *U. S. S. Trenton* at sea.

"The tests of radio-vision apparatus for broadcasting daily weather maps to ships at sea, as well as to others interested, although still in the experimental stage, show that such broadcasting is sound in theory and has considerable promise of being entirely practicable," continues Mr. Dashiell. "But little is known as to the effectiveness of operation over considerable distances and during unfavorable conditions, such as static, wavelength interference, fading, the rolling of vessels, et cetera. These potential sources of trouble are being gradually investigated. Reception by the *Trenton* and *Kittery* was not entirely satisfactory, due to static and the rolling of the vessels, but maps were received by the *Kittery* as far south as Guantanamo Bay, Cuba. It is hoped that more tests can be conducted under seagoing conditions as improvements in radio and in the mechanical part of the transmission are made from time to time.

"The Weather Bureau's experience, as well as that of the observers aboard the naval vessels, is that a map can be received through much static without destroying its value. All static impulses passing through the radio set are recorded as marks of various lengths on the map. This static would seriously interfere with ear reception of coded bulletins and, in many cases, may prevent the obtaining of sufficient data to prepare a map at sea. One map was received at the Weather Bureau during a heavy thunderstorm but the isobars and other data were quite legible. Incidentally, the recording of static impulses by this machine show some interesting actions of the electric waves that are propagated by lightning discharges.

"In order to conduct still further tests under other conditions, a 45-meter short-wave transmitter of the Jenkins Laboratories at Washington is also used. Experiments are being carried on between Washington and Chicago using both short- and long-wave transmissions. It is hoped to speed up the time of reception from 50 minutes to approximately 15 minutes.

"A description of the operation of the Jenkins system in transmitting the weather map will be of interest. A map is drawn in black ink on a special base. A photographic negative is then made of it, by direct contact printing. This is taken at once to the broadcasting station and placed in the transmitting machine.

"The transmitter consists, in brief, of a glass cylinder, about which is wrapped the photographic negative. The cylinder is revolved at a constant speed by an electric motor. Within the cylinder is a small but powerful electric light. Outside of the cylinder is a light-sensitive photoelectric cell which is arranged so as to move along in front of the length of the cylinder at the rate of one-fiftieth of an inch for one complete revolution of the cylinder. This cell has a very small aperture and the light from within the glass cylinder passes through and affects the sensitivity and electrical conductivity of the cell. The electric light within the cylinder advances with the cell so as to be always opposite the aperture.

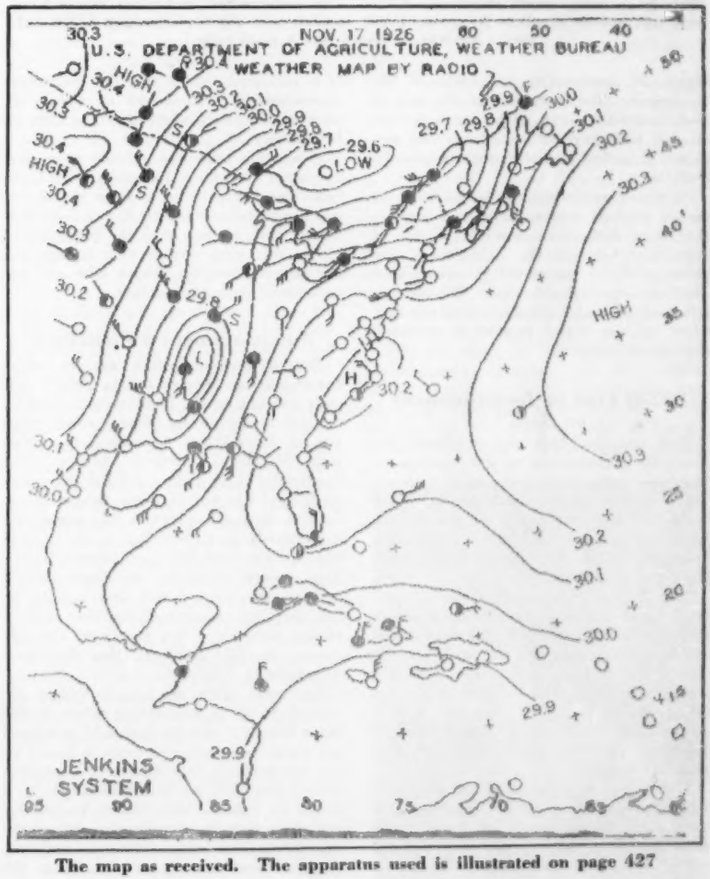
"As the black and white portions of the film (the whites being transparent and the darks opaque) rotate before the aperture of the cell, the light passing through from within is intermittently cut on and off and the conductivity of the cell is varied accordingly. But as the cell is advancing along the cylinder from one end to the other at the rate of one-fiftieth of an inch to each revolution and the diameter of the aperture is the same, it will be seen that the same transparent place on the film never passes before the cell opening more than once.

"As the light is broken up into impulses of various durations by the white lines of the film, it causes corresponding variations in the electrical resistance of the cell. These resistance changes cause sharp fluctuations in the flow of current through the cell.

"In order that this very weak current may be strengthened so that it will operate the relays of the powerful radio set, it must be passed through a number of alternating-current transformers and amplifying electron tubes. A pulsating direct current through the cell is obtained by breaking up the light waves by means of a chopper wheel rotating in front of the electric light within the cylinder. This pulsating current can be transformed into alternating current so as to pass through any number of amplifying units necessary. The signals sent out by the radio station are similar to code signals except that they are a meaningless jumble of dots and dashes which are confusing to the uninitiated radio operator.

"These may be received by any type of radio set capable of tuning to the wavelengths used and, after being suitably amplified, are passed to the map reproducer. A sheet of white paper is wrapped about a rotating cylinder of the same size as the one on the transmitter. Both cylinders operate as nearly as possible at the same speed and, as the radio impulses come in, a magnetic pen traces lines on the rotating paper to correspond with the transparent whites of the negative. The pen advances at the same rate as the photoelectric cell before the rotating cylinder and the map is reproduced by a large number of fine lines marked in their proper positions and drawn in a very flat spiral around the paper on the cylinder.

"If the speeds of the two machines differ,



The map as received. The apparatus used is illustrated on page 427

the picture will be more or less distorted. Constant and equal speed of both machines is mechanically impracticable; hence it has been found necessary to synchronize the cylinders at each revolution. A special synchronizing master signal is transmitted at the end of each revolution of the sending machine, to hold the receiving cylinder from revolving until the end of this signal comes. In this way each new revolution begins in synchronism with that of the transmitter. The hesitation at the end of each revolution is very slight, but it is sufficient to keep any number of receiving machines in perfect step with the transmitting machine.

"A photographic recorder is not used, as such a machine is complicated and requires the use of dark rooms, careful handling of sensitive films, and the development and printing of the completed picture, all of which consume valuable time. The receiver now used instantly reproduces with ink and, when the last signal impulse is recorded, the map is complete."

* * *

"$250 Fine or Imprisonment or Both"

THE title indicates the penalties that Uncle Sam admonishes us will be imposed upon those who remove or tamper with the bronze tablets set in various places by the Coast and Geodetic Survey of the Department of Commerce to indicate boundaries, hydrographic stations, magnetic stations and elevations above sea level.

After spending thousands of dollars and much valuable time in making accurate surveys and placing these bronze markers at various points throughout the country where they tell their own story to engineers and scientists who use them as foundation stones for further work, Uncle Sam has decided, writes Louis E. Reichard, that it is good policy to warn the public against trifling with his property.

The reason for his decision to punish offenders who fail to heed his warning is a good one. Years ago, after surveys had been laboriously made, government representatives used markers made of concrete. The markers were blocks about the size of a fence post. They were buried their full length in the ground in an upright position, and the tops were usually covered with leaves and dirt in order to lessen the likelihood of discovery. However, despite these precautions, they were discovered from time to time and queer uses were sometimes made of them by people who seldom had any idea of the trouble they were thus causing government surveyors. For example, they served as door steps to cabins and even as tombstones! Often they were removed from the ground by persons possessed of more imagination than judgment, in the belief that they marked the hiding place of great treasure.

It remained, however, for a practical son of balmy Florida to use them on a wholesale scale and for an unique purpose: he gathered them from far and near until his collection numbered approximately two dozen. He then used them to build a bake oven!

This bake oven, worth about ten dollars, and constructed of United States Government survey markers by an ignorant vandal, cost the Government 5,000 dollars. Anyway, it looks like a good oven!

It is estimated that it cost the government approximately 5,000 dollars to replace the markers accurately where they had been set by surveyors.

It was the bake-oven episode more than any other one thing that convinced Uncle Sam that it would be a wiser practice to use bronze tablets bearing inscriptions indicating their purpose than the plain cement blocks that were put to such strange and unexpected uses by people who did not understand their real purpose.

* * *

Nampeo Stages a Comeback

THE quantity-production age in which automobiles are turned out in 100,000 lots daily has put on the hand-made a premium that has been a perfect lifesaver to the tribal arts of the original Americans, says Marjorie MacDill of *Science Service*. The handicrafts of the Indian and Eskimo, which civilization has put in grave danger of extinction, have come back to life again with a vengeance, as retired Babbit, not to mention his wife and daughter, turns collector. The modern craze for the hand-wrought antique, the bizarre and, less necessarily, the beautiful, augmented by the all-penetrating automobile, has convinced our precursors on this continent that they have something to sell.

The time when an Indian woman expended hours of painstaking effort modeling a beautiful clay jar that sold to a passing trader for twenty-five cents is past. To day she demands 35 dollars of the transient tourist and gets it; and very often it is worth even more. This ready market for Indian products has produced some surprising results that range from the crude art of the Indians of southern Alaska to the beautiful pottery made in the southwest.

In the Hopi pueblos there is an old woman called Nampeo who has staged a most amazing comeback of the ceramic art of her tribe. Ethnological experts on early American races tell us that the pottery of the Hopi reached its apex of excellence during the pre-history of the pueblos. Since this period, the designs have degenerated steadily, though it still is the best native pottery made in the United States.

During some of the early investigations in the southwest, undertaken by the Smithsonian Institution under the direction of Dr. J. Walter Fewkes, some exceedingly fine specimens of early Hopi jars were brought to light. Nampeo, then a young girl, was so impressed with the beauty of the handiwork of her remote ancestors that she attempted to copy some of the designs in the jars that Hopi women make for household use. Since she was an artist of a caliber that occurs but rarely in any race, her attempts were successful. Her pottery, copied after samples 2,000 years old, approaches the excellence of her models.

When she had the opportunity to see any of the old specimens of the ancient Hopi jars and bowls she copied their designs down on paper for future use. She hunted up the same sort of clay the old potters used and endeavored to emulate their technique, generally with highly satisfactory results. Thanks to Nampeo, Hopi pottery again approaches some of its pristine glory.

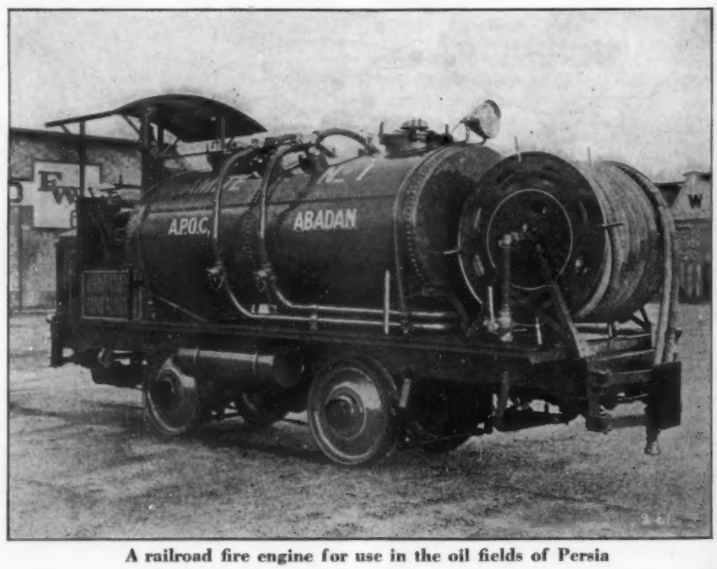
* * *

A Railroad Fire Engine

AN interesting application of the automobile for railroad purposes is the three-foot gage railway fire-engine recently constructed for the Anglo-Persian Oil Company for use in the great oil refinery at Abadan, Persia.

The requirements of this fire engine, depending as they do upon the conditions obtaining in refineries in tropical countries, called for a special design. "Foamite," the fire-fighting mixture used, is composed of two solutions, and 425 gallons of each of these solutions are contained in a double compartment steel tank, the acid compartment being lined with lead throughout.

Pumps deliver the fire-fighting solutions into twin hose mounted on a revolvable drum, which is placed above the pumps. The hose-drum revolves on special gland bearings, which permit the hose to be uncoiled while the solutions are passing through. Thus it is unnecessary to uncoil more than the required length of hose—a convenience where space is restricted. The locomotive is driven on all four wheels. Running tests of the locomotive, which is operated by gasoline in the manner of an ordinary truck, showed good acceleration to a speed of about 30 miles per hour.



A railroad fire engine for use in the oil fields of Persia

* * *

The Scientist and the Alcohol Question

PROFESSIONALLY the scientist is interested in but two sorts of alcohol, says Dr. H. E. Howe, Editor of *Industrial and Engineering Chemistry*. He requires the purest of alcohol, whether it be methanol, ethyl or grain alcohol, or one of the so-called higher alcohols for his research work. This, in educational institutions, can be obtained tax-free in accordance with established regulations. If the scientist is connected with the industries, he recognizes that alcohol is second only to water in its importance as a solvent and he requires large quantities at a low price for manufacturing purposes.

Twenty years ago laws were passed to encourage industry by providing for denatured alcohol which could be sold tax-free, after having been rendered unfit for drinking by the addition of methanol or wood alcohol, pyridine, benzol, and a large number of other substances. These substances were chosen with a view to rendering the alcohol unfit for drinking without interfering with the industrial applications intended, and many chemists cooperated in devising the formulas which at one time or another have been approved by the Treasury Department.

The layman has little appreciation of the wide use of industrial alcohol and the fact that many materials cannot be made without it. Literally hundreds of thousands of dollars have been spent in an effort to find satisfactory substitutes for alcohol in the industry, since obviously no manufacturer would submit to present-day regulations on a basic raw material if he could use something else.

The practice followed by the Federal authorities in denaturing alcohol is not materially different from that approved by many other countries; and indeed methanol, against which attacks have been launched in the past several months, is used in much larger quantities abroad than in alcohol denatured under the regulations of the United States Government. The industries have no objection to methanol and the complaint comes either from those who desire to unravel denatured alcohol in order to divert it into beverage channels, or from the group who are opposed to prohibition and who have apparently decided to harass all and sundry to the point where they fancy some united demand may be made for the repeal of prohibition. Whatever the individual views may be concerning prohibition, industrial chemists are united in opposition to the tactics being employed, which, if continued in the press and by politicians, may lead to a situation where industry will find it necessary to fight for a raw material that has become essential.

Care is taken to market completely denatured alcohol under poison labels. The material as it leaves the hands of the denaturer is not potable, and yet those who would criminally manipulate this material seek to charge the Government with death which may occur from the illegitimate manipulation and use of this chemical compound. Industry finds it necessary to continue under existing conditions, while at the same time seeking the ideal denaturant which thus far no one has discovered. The alcohol producers have established a fellowship at Mellon Institute and have taken other steps to cooperate in this search.

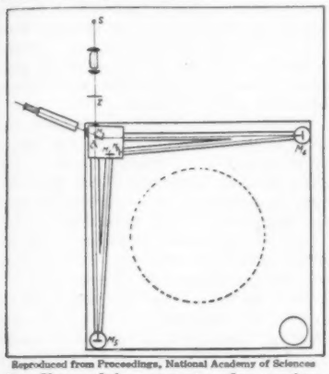
If those who are so largely protesting the use of methanol do so in good faith, an

equal amount of energy contributed to the effort to find an ideal denaturant would be far more constructive and much more in line with the interests of the industry as well as of the people at large.—*Science Service.*

* * *

New California Experiment Supports Einstein Theory

WHAT is said to be a new point in favor of the validity of Einstein's theory of relativity is contained in a series of experiments recently completed by Dr. Roy J. Kennedy, of the California Institute of Technology, and which have been reported to the National Academy of Sciences.



Reproduced from Proceedings, National Academy of Sciences

Dr. Kennedy's apparatus for testing the question of ether drift is a reduced copy of Michelson's original apparatus. *S* is a mercury lamp. A monochromatic light ray passes through a hole in screen *Z*, is split by the half-silvered mirror *M3*, the parts going respectively to mirrors *M4* and *M5*, whence they are reflected back to mirrors *M1* and *M2*. Here they are dealt with by an interferometer which ought to show a shift of interference bands if there is actually an ether drift

The experiments were a repetition of the famous Michelson-Morley experiment, named after the physicists who first performed it many years ago. It was intended to show whether or not the earth, on account of its motion, was drifting through the ether, which was supposed to permeate all space, and to be the medium in which light waves vibrate. When first performed by Michelson and Morley, an almost negligible result was obtained. It was partly in an effort to explain this unexpected result that the theory of relativity was formulated.

When the experiment was repeated last year by Dr. Dayton C. Miller, of the Case School of Applied Science, Cleveland, working at the Mt. Wilson Observatory in California, a mile above sea level, an apparent effect was found. While this was not as great as had been originally expected, Dr. Miller said that it could be explained by a motion of the sun, and the earth with it, towards the constellation of the Dragon, at a speed of over 100 miles a second. This was antagonistic to the relativity theory as it now stands.

Dr. Kennedy has repeated the experiment with an improved form of apparatus, in which the beam of light, which is divided into two parts and then recombined, causing alternate light and dark "interference" bands, travels only about 13 feet, instead of more than 200 feet as in Miller's apparatus. The effect sought for is measured by means of a shift in these interference bands as the apparatus is pointed in different directions. With the instrument used by Dr. Miller, says Dr. Kennedy, a difference in pressure of one twenty-five thousandth of a pound per square inch in the air through which the two parts of the divided beam pass, would produce an effect as great as that observed. A temperature difference of a five-hundredth of a degree, Fahrenheit, would produce the same effect, he stated.

As Dr. Kennedy's light path was so much shorter, there was much less chance of such error, and the entire apparatus was small enough to be completely enclosed in a sealed metal case containing helium gas, which was at atmospheric pressure. This prevented circulation of the air; also any difference in pressure or temperature in different parts of the apparatus.

By means of an improvement in the way of observing the interference bands, the instrument is as sensitive as Dr. Miller's, despite the shorter light path. However, although "a shift as small as one-fourth that corresponding to Miller's would be perceived," said Dr. Kennedy, "the result was perfectly definite. There was no sign of a shift depending on the orientation. Because an ether drift might conceivably depend on altitude, the experiment was repeated at the Mt. Wilson Observatory. Here again the effect was null."—*Science Service.*

* * *

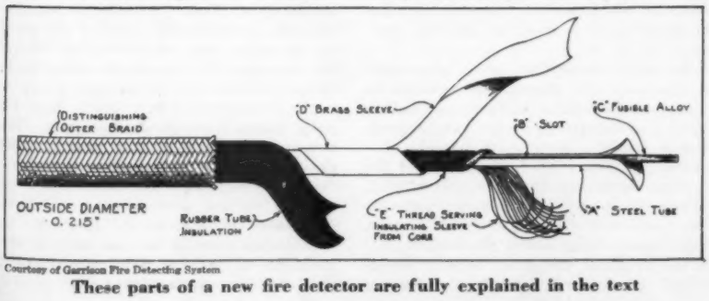
A New Development in Fire Alarms

ALL fires have heat, some do not have smoke and actual flame but all are evidenced by a rise in temperature.

It is upon this predication that a most ingenious fire alarm system which is adaptable to every possible condition or situation, has been devised. The heart of the system is the automatic, continuous thermostatic wire, which is but three-sixteenths of an inch in diameter and can readily be run anywhere. Details of this device are shown in our illustration. Two conductors, the core *A* and the brass sleeve D, constantly carry electric current. Thread E insulates the core from the sleeve. The core consists of a steel envelope carrying an alloy of considerably lower melting point. Heat, readily transmitted to the alloy, causes it to melt and expand at predetermined degrees of temperature, and globules of the alloy are forced through the slot of the core and through the thread insulation, until contact with the brass sleeve takes place. Thus a short circuit results. A relay is consequently actuated which indicates by a light on a main control panel just where the fire is, and a code transmitter rings the bells correspondingly. Should more than one fire start, the relay of the second cannot be effected through the first, until this signal is completed, when a contact finger is then set, allowing the second signal to pass through to the proper relay.

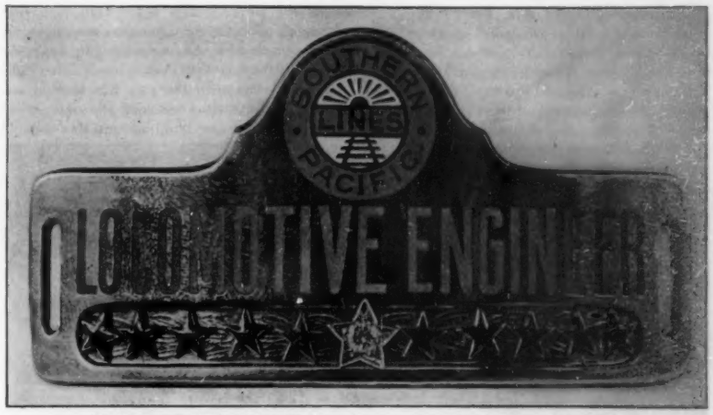
Duplicate sets of storage batteries keep the circuits under surveillance at a small expenditure of power, and a floating trickle charger assures full power at all times. Either battery will operate the system and as one set is always guarded, the system cannot be tampered with to make it inoperative.

With commendable judgment this system is built up by using batteries, relays, panels, transmitters, contactors, meters, et cetera, already manufactured and of proved worth, thus eliminating experimentation and guaranteeing that all the actuating parts will give unfailing response.



Courtesy of Garrison Fire Detecting System

These parts of a new fire detector are fully explained in the text



Badge awarded to Mr. Falvey for not wasting locomotive fuel

* * *

Age-Old Pollen Dates Relic of Bronze Age

A WOOLEN mantle, worn in Sweden when the early Pharaohs still reigned in Egypt, has had its age approximately determined by a curious combination of botanical and geological knowledge, through the researches of Dr. Lennart von Post of the Museum of National Antiquities in Stockholm, Sweden. The garment was found buried at a depth of several feet in a peat bed in the district of Vastergotland, carefully folded up and weighted down with three stones, but with nothing about it to indicate how it got there.

Its similarity to Bronze Age garments from Denmark and elsewhere suggested its antiquity. The fact that it had evidently not been buried, but had lain in its hiding place while the moss grew over it to form about five feet of peat, was further evidence of great age. The acid water of the bog had preserved it from decay during the centuries.

Dr. von Post found the key to its age in the pollen grains that were thick in muddy particles clinging to the fabric. Most important among the species represented were oak, linden and elm, with pine, birch and alder, and hazelnut as the principal shrubs. Exact counts showed that the proportion of the pollen from the oak-linden-elm forest was larger than it would be in a Swedish springtime "pollen rain" of today, indicating the existence of a milder climate in the north at the time the mantle was laid away.

Such a mild climate is known from geological evidences to have followed shortly after the disappearance of the last patches of glacial ice in the south of Sweden, at about the time when the New Stone Age was giving way to the Age of Bronze in that country. It was followed by a period of severer climate, ushering in the Iron Age. This mild-climate pollen thus determines the former owner of the mantle, who so carefully folded it up and hid it under three stones in a ditch, as a man of the Early Bronze Age.—*Science Service.*

* * *

Wins Diamond Award for Conserving Fuel

J. R. FALVEY, Southern Pacific engineer on the Overland Limited, has been repeatedly acclaimed the world's most efficient railroad engineer. As the "high" man in a world-wide contest conducted by *Railway Age*, his record for fuel conservation recently won him an extended trip to Chicago.

A fuel-conservation award was originated by the Southern Pacific Company on its western division in 1922. At the end of each quarter, the most efficient engineer was to be presented with a gold badge to be worn on the cap. If any meritorious individual should excel for more than one quarter, a gold star was to be attached to his badge. Falvey has won more gold stars than could be affixed to his badge and has led the 2,500 competing engineers for the entire 39 months during which the contest has continued.

Officials decided that some appropriate recognition must be given, so Falvey was presented with a diamond for his badge. This diamond can be seen in the center of the gold stars in one of the photographs. Falvey has acquired such skill in fuel conservation that his employers say that during his entire 36 years of service for the company, his efficiency has never fallen to the average record, even for a single trip.

Pyramiding costs and the gradually widening breach between production and consumption of crude oil in California is each day bringing to railway-operating officials and executives a problem of more and more serious proportions.

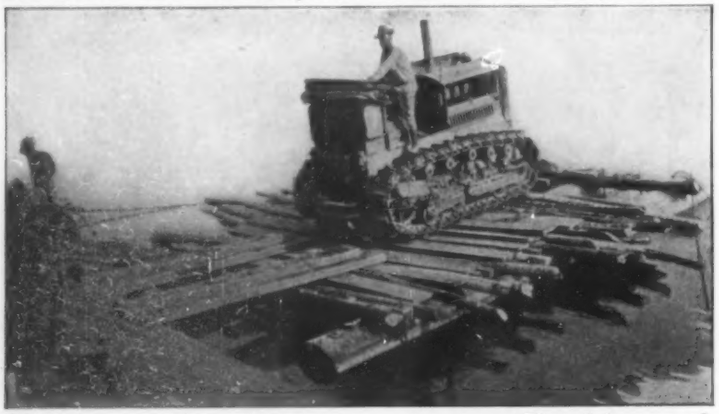
In years past, when crude oil was sold in the open market at a price even less than one cent per gallon, scant attention was given to the thought that, in the future, conservation of this commodity would have to be practiced, or that the cost would rise to a level which in railway operation would become an absorbing factor. Now, however, because the Southern Pacific Company uses fuel oil exclusively on nine of 12 divisions in locomotive operation on its Pacific system, and depends entirely on California fields for its supply, the situation is of the greatest concern to this company.

With the supply of crude oil limited and consumption increasing, and with prices soaring, the Southern Pacific Company has taken extensive steps to conserve oil. This has resulted in a saving of 2,915,747 barrels of fuel oil in freight and passengers service on the Pacific lines from 1920 to 1926.

Mr. J. R. Falvey, engineer on the Southern Pacific Railroad, who holds the record for fuel conservation

Tractor Floats on Novel Raft

A PHOTOGRAPH reproduced in these columns shows a novel raft which was constructed by the Andean National Corporation for carrying a "caterpillar" tractor across the Sogamossa River in Colombia, South America. The raft was built by bolting four long metal tanks together and then placing boards and limbs across the top. Heavy planks were used in running the tractor from the bank to the raft and vice versa.



This is one way to float a ten-ton tractor across a stream. The raft is composed of four cylindrical tanks and a wooden platform

* * *

A Tenth of a Thousandth of a Millionth of an Ampere

AN instrument that indicates a change in current as small as a tenth of a thousandth of a millionth part of an ampere has been developed in the standardizing laboratory of the West Lynn works of the General Electric Company as a part of the equipment which replaces the human eye in making tests on incandescent lamps, currents in insulators, radio tubes, and so on. The instrument, known as a "thermionic microammeter," has a full-scale reading of a tenth of a millionth of an ampere, with subdivisions of one five-hundredth of this amount. It is the most sensitive instrument of such a long scale length, working on jewel bearings, that has ever been built.

The usual 40-watt Mazda lamp, which consumes less than one-half cent's worth of electricity an hour, uses 2,000,000,000 times as much current as the amount represented by one subdivision on the scale of this instrument.

This microammeter has been combined with the photoelectric cell in the development of photometric apparatus which is far more susceptible to variations in intensity of light than is the human eye. The light output of lamps in the past has been measured by contrasting visually the amount of light given by the lamp in question with a known amount of light given by a standard lamp. Such a method is far less accurate than the new method, in which the human eye has been replaced by the electrical eye—the photoelectric cell—and the individual is required only to make scale readings of lumens or candlepower in the same manner as he would read volts or amperes on an ordinary laboratory standard instrument.

The photoelectric cell is a vacuum tube which is extremely sensitive to any changes of intensity of light falling upon it, because its internal resistance varies with the intensity of the light reaching it. This property of the cell has been utilized in many ways, such as in transmitting photographs by radio, in making talking motion-pictures, in an improved method for manufacturing phonograph records, and in different methods for accurately matching colors.

Except for a small circular area, the inside of the bulb of the photoelectric cell glistens with metallic potassium. Depending upon the amount of light striking it, this metal permits a varying amount of current to pass through the cell. The more light, the more current. Each little increase in the amount of light striking the window of the cell is almost immediately responsible for an infinitesimal increase in the amount of current passing through the circuit of the cell.

Courtesy General Electric Company

The microammeter which measures one 10,000,000,000th of an ampere

For use in photometry, the photoelectric cell is located on the exterior of a spherical photometer, or Ulbricht sphere, with its window adjacent to the small window in the surface of the photometer. The photoelectric cell and the microammeter are then connected in series across an ordinary radio "B" battery, of 45, 90 or 135 volts. The amount of light given off by the lamp under test lowers the resistance of the cell, causing a current to flow through the photoelectric cell and microammeter circuit which, in turn, produces a deflection on the microammeter scale.

* * *

Highly Sensitive Instruments to Measure Sun's Heat

SEVEN silver-disk pyrheliometers are shortly to go out from the Smithsonian Institution to India, Switzerland, Germany and various observatories in the United States. The world has accepted these instruments as standard for measuring the sun's heat as received at the face of the earth. They were invented and perfected by Dr. C. G. Abbot, assistant secretary of the Institution, in the course of his researches on solar radiation, and they are made only at the Institution. Since 1913, some fifty of them have found their way to government and private observatories here and abroad.

The basis of the apparatus is a blackened silver disk as big as a half dollar and three times as thick, contained in a tube with a small aperture to permit the entrance of a sunbeam. The disk absorbs the rays and is warmed. A cylindrical bulb thermometer is inserted in the silver disk, to record the effect of the rays. Each thermometer has to be corrected to insure an accurate reading.

To check the accuracy of the silver disk instruments, Dr. Abbot also invented a water-flow pyrheliometer, a more complicated and delicate instrument whose precision is known to some ten-thousandths of a degree. Of this instrument the head of the German meteorological service said in 1913, "There is but one standard pyrheliometer in the world, and that is at the Smithsonian Institution's Astrophysical Observatory."

The universal acceptance of these instruments as standard indicates the leading position which the Smithsonian occupies in the study of solar radiation.

Besides the pyrheliometers, the Institution has perfected for the world the bolometer, which measures the heat of the separated rays of the spectrum, recording temperature changes as low as one-millionth of a degree; Secretary Longley invented the bolometer, but Dr. Abbot has improved it greatly.

The pyranometers are due to Dr. Abbot and Mr. Aldrich jointly. One is for measuring the intensity of the sky's brightness, while the other measures the radiation of the earth to space. This second instrument, called the honeycomb pyranometer, is the only apparatus in the world which has measured the radiating capacity of the human body. In collaboration with Dr. Benedict of the Carnegie Institution's Nutrition Laboratory, Dr. Abbot experimented some years ago to find that the human body was an almost perfect radiator.

One of these honeycomb pyranometers was taken to the Arctic Circle in the *Maude* when Amundsen's colleague, Sverdrup, was trying to drift across the North Pole, and many measurements were taken of the earth rays going out through Arctic night.

One of the rarest achievements to the credit of the Smithsonian astrophysicists was the measurement of the sun's heat at a point 15 miles above the surface of the earth. To accomplish this, Dr. Abbot prepared a modified form of the silver-disk pyrheliometer to be attached to a pair of sounding balloons made of expansible dental rubber. In cooperation with the United States Weather Bureau balloon experts, this was released by Mr. Aldrich of the Smithsonian, from Omaha in 1914. It ascended 15 miles, automatically recorded the intensity of solar radiation where 24/25ths of the atmosphere lay beneath it, collapsed one of its balloons and was wafted gently to earth. It was picked up safely in Iowa 150 miles distant from its starting point. The measurements agreed almost exactly with the results computed from those made at the earth's surface by the Smithsonian, and so, it is claimed, gave strong proof of the correctness of the theory employed by Smithsonian scientists in their study of the variability of the sun which may make a new basis for weather forecasting.

Courtesy of the National Geographic Society

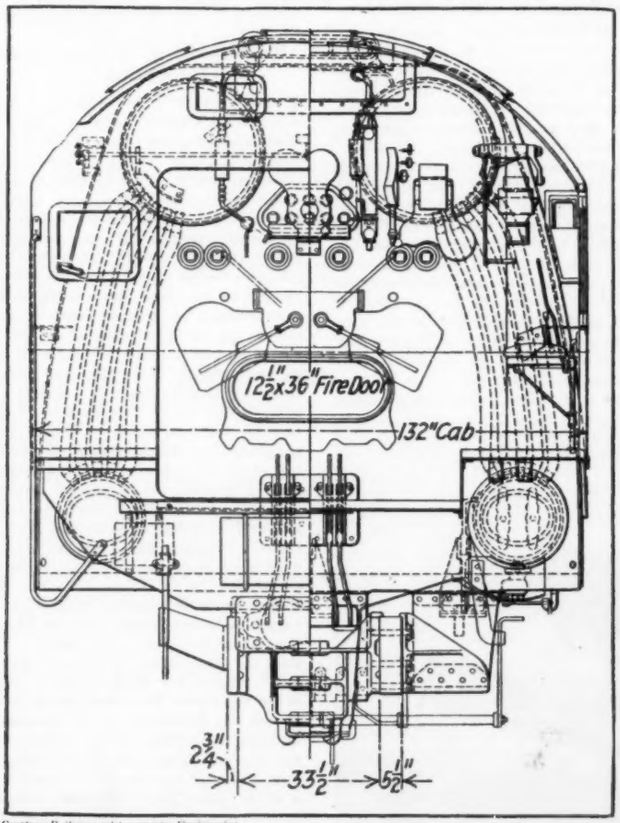
Dr. Abbot's right hand rests on the silver-disk pyrheliometer. At his left hand is his improved galvanometer

It Proved to Be a Success

THE new and special type of locomotive which we described in the issue of March, 1925, having water-tube boilers in addition to the fire-tube boilers of the ordinary locomotive, and generating steam at the comparatively high pressure of 350 pounds per square inch, has subsequently performed so well that the Delaware and Hudson Railroad Company has ordered another locomotive of the same type, but designed to use steam at 400 pounds per square inch. This is twice the steam pressure of the ordinary locomotive of the present period.

By combining a number of modern advances in engineering practice, chief of which is the high pressure employed, a greatly increased overall efficiency was obtained from the *Horatio Allen*, as the first of these locomotives was named. There is a disproportionately greater increase in the energy recoverable from steam at higher and higher pressures, and this would provide an easy way of getting something for nothing were there no drawbacks, such as the unusual nature of the necessary equipment and its added cost.

The water-tube boiler is the kind used on warships and many later steamships. The many tubes of which it is principally composed lie parallel to one another and the fire circulates *around* and among but not inside of the tubes. The fire-tube boiler is just the opposite—the fire passes *through* the tubes which are open at the ends and the space between them is occupied by water. Heretofore it has not been considered practicable to install a water-tube boiler on a locomotive, chiefly because of its shape, which is not as compact as that of the less efficient fire-tube boiler. However, on the *Horatio Allen* this was overcome, although it results in a locomotive of rather unconventional outlines. Here the two are combined: the flames pass over the water tubes, which account for four-fifths of the heating surface, then through a fire-tube boiler.



Courtesy *Railway and Locomotive Engineering*

A cross-section of the rear portion of the boiler of the *John B. Jervis*, a recent type of locomotive using a steam pressure of 400 pounds

Railroad men have been conservative in the adoption of higher pressures in steam. They have consistently lagged behind progress in stationary practice. "More than 25 years ago," says *Railway and Locomotive Engineering* (New York), "when 150 pounds steam pressure was common, and 180 pounds above the average, Muhlfeld, the designer of the *Horatio Allen*, designed an engine for the Canadian Government Railways with a boiler pressure of 250 pounds per square inch, which at that time was considered by most railway men as simply out of the question. In 1904 he brought out the first Mallet compound in America for the Baltimore and Ohio Railroad, with a steam pressure of 235 pounds. Many looked at it with a suspicious eye and muttered, 'it won't do,' but many were subsequently built that saved millions of dollars for our railways. . . ."

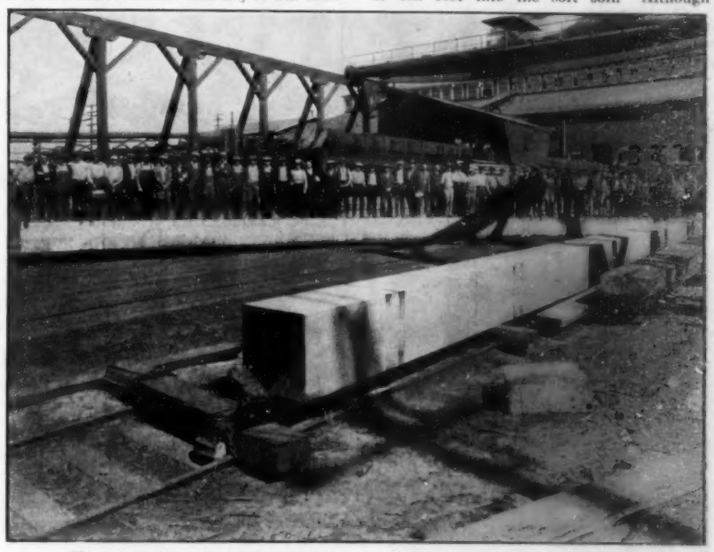
"For many years," continues this journal, "the water-tube boiler was looked upon as of doubtful utility in marine and stationary practice, while for locomotive use it was not seriously considered until quite recently. Mr. Muhlfeld has not alone used the water-tube boiler successfully for the past two years in the *Horatio Allen*, with 350 pounds steam pressure, but with slight improvements which experience suggested, he finds it most suitable for the *John B. Jervis* with 400 pounds pressure."

The *John B. Jervis* is the new locomotive first mentioned, and its specifications, as outlined in *Railway and Locomotive Engineering*, vary but little from those of its prototype of two years ago except in the matter of steam pressure. Thus we may assume with reasonable safety that pressures of at least 350 pounds per square inch in locomotive boilers have arrived and will stay, while the suggestion that higher ones will follow, strongly implied by the Delaware and Hudson's investment in an engine using steam at 400 pounds pressure, is not entirely out of place.

* * *

Big Timbers Still Available

IN our illustration fifty-two men are shown standing on a "spud." A spud is a timber thrust to the bottom to hold a dredge firmly when working. For such a job of deep-water dredging, a Philadelphia Company needed in a great hurry, two spuds 80 feet long and 28 inches square at the ends. A western sawmill took the contract and had the spuds ready for delivery within seven hours after receiving the order. It is doubtful that any other material could have been worked into shape in such a short time, or that any of our territory other than the forests of the Pacific northwest could have supplied the logs. In such mills as these it is not uncommon to handle logs of full tree-length, ranging up to 250 feet in length, and to have them on hand for rush orders of the type here detailed. The wood is Douglas fir.



Heavy timber "legs" for a dredge. These beams are 80 feet long

* * *

California Engineers Help the Colorado River to Make Its Own Levees

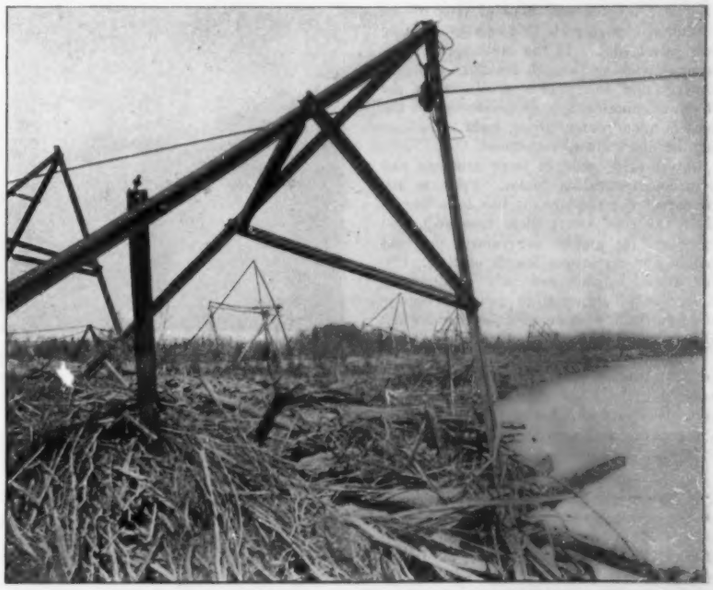
THE Colorado River, third largest in America and probably the most erratic and difficult to keep within bounds because its self-made banks and bed are composed of silt that dissolves like powdered sugar, is now being controlled, in a measure, with steel tripods.

These unique devices, which have proved their effectiveness, are employed in the vicinity of Blythe, 150 miles below the Boulder Dam site and 240 miles from Los Angeles. They were conceived by Floyd Brown, a former chief engineer of the Palo Verde Valley Mutual Irrigation District, and are a strange sight. The average observer wonders what the grotesque skeletons, usually set in ragged rows, are for.

They are made of ordinary railroad rails, strongly bolted together in well-braced tripod form, and stand about 20 feet above the ground. They also extend downward eight or ten feet into the soft soil. Although they each weigh considerably more than a ton, they are sometimes placed in concrete bases in order to give added heaviness and stability.

When the powerful current of the river begins to cut into the bank and threatens a change of course, the tripods, handled by stiff-legged derricks mounted on a power ferry or on barges towed by motorboats, are placed in the stream in single or parallel rows and are securely tied together with one-inch steel cables. Immediately these lines collect whatever brush and driftwood the flood may bring them, then the silt is deposited, and soon a solid bank is created.

Not only do these tripods confine the river to its channel in time of high water but they are also exceedingly useful when the flow is low and it is desired to turn more water into the main irrigation canals. In that event they are placed transversely in the stream just below and opposite the intake, where they quickly form a substantial diversion bar, raising the water plane to the extent that may be required. So far as can be ascertained, this odd contrivance is not applied anywhere else in the world.



How the Colorado River in Southern California is controlled by steel tripods. The cables binding these together quickly collect driftwood and silt, thus forming a barrier to keep the river in its course

Aircraft are being put to use in peace as well as in war. This department will keep our readers informed of the latest facts about airships and airplanes

Conducted by Alexander Klemin

In charge, Daniel Guggenheim School of Aeronautics, New York University

Ballooning Revival

ACCORDING to R. H. Upson, designer of the metal-clad airship, *MC-2*, free ballooning remains as valuable a method as ever of advancing knowledge in meteorology, navigation and aerostatics. It is also a most delightful sport. It is gratifying to learn that there is a distinct revival in free ballooning and that a Balloon Section of the Detroit Flying Club has been organized.

R. H. Upson, designer of the *MC-2*

The club owns its own balloon, two balloons are the property of members and at least one flight a week is being made.

Bids for Air Mail

KEEN competition attended the opening of sealed bids by Postmaster General Harry S. New for the carrying of mail by air between New York and Chicago, and Chicago and San Francisco. With the acceptance of these bids, the great transcontinental airway will pass from Government ownership to private hands, closing a wonderful chapter in the history of American aviation. The bids were not only close but astonishingly low. Between New York and Chicago, a distance of 771 miles, the lowest bid was only $1.73 per pound of mail. Assuming 17 letters to the pound, and ten cents extra postage per half ounce, the Post Office would do very well on the deal. Whether the contractor can "break even" is another story.

Aircraft in Forest Patrol

THE Canadian Department of the Interior takes a very hopeful view of the further use of aircraft in forest-fire fighting and patrol work. In the great forest territories stretching through Northern Quebec, Ontario and the prairie provinces in the Rocky Mountains, a large percentage of the area is under water, giving ideal conditions for the operation of seaplanes.

Forest fires occur in large numbers and occasion tremendous losses. Prior to the advent of the airplane, it has been impossible either to detect these fires or to get labor on the ground for control purposes within any reasonable length of time. Flying boats, capable not only of detecting fires, but of transporting men and equipment to them, offer an effective, and in fact the only feasible method of control.

The great difficulty seems to be that of costs. Airplanes are now expensive to operate, but the Department sees many signs of a downward revision of these costs after the experimental period has been passed.

A Great Bomber

IN the April, 1926, issue of the Scientific American, we were able to give some details of the internal construction of the Huff, Daland Company's *Cyclops*, the largest single-engined bomber in the world. Recently completed, it is now undergoing an exhaustive series of tests by the Army Air Corps at McCook Field, Dayton, Ohio.

The design of such a bomber is extraordinarily complicated. While the huge 17,000-pound plane is fast enough (it is estimated to have a top speed of 135 miles per hour) it cannot possibly outmaneuver a fighting plane. Therefore, it must be provided with enough guns to give it a fighting range in every direction. The *Cyclops* accordingly carries ten guns, some projecting below through the floor, some in a movable gun turret at the rear, and so forth. An attack from an enemy aircraft can be met from any direction.

The destructive power of a bomb goes up much faster than its weight. Hence the reason for the attempt to carry the weight of bombs higher and higher. The *Cyclops* can carry either one 4,000-pound bomb, two 2,000-pound bombs, or four 1,000-pound bombs.

During the World War and for many years after, we came to associate the large bomber with a multiplicity of engines. But this was merely because a large enough or powerful enough single engine-unit was not available to provide large bomb-carrying capacity. With the advent of such engines as the Packard 12-cylinder, of 800 horsepower, the advantage of the single-engine bomber in giving a "cleaner" ship, with greater speed and endurance had to be taken into serious consideration by the Army Air Corps. The tests seem to be justifying the construction of the *Cyclops*. With full bomb and machine-gun equipment and with a crew of eight men, it will have a range of 1,000 miles. With gasoline substituted for the bombs and other ordnance, it will be capable of a non-stop flight of 24 hours' duration, which could carry it easily from New York to Paris. Perhaps the *Cyclops* will be one of the many airplanes that is to attempt a transatlantic flight this summer?

Herbert Photos

Made by the Huff, Daland Company, the *Cyclops* is the largest single-engined bomber in the world. Note the man in this photograph

Maintenance of Dural Pontoons

DURALUMIN is rapidly replacing wood in the construction of pontoons. The metal floats are lighter, soak up far less water and are more durable. These advantages outweigh the somewhat greater cost. The one thing to guard against is corrosion, but the precautions are simple. All surfaces must, at all times, be covered with two coats of good aluminum enamel, and all surfaces before painting must be free of dirt, grease or oil and thoroughly washed with vinegar.

According to the engineers of the Edo Aircraft Corporation, who make a specialty of such construction, inspection must be made periodically every 60 days, particularly at such sections as the keel at the step, which is the lowest point in the pontoon. Corrosion of dural in its elementary state appears as faint white spots; in a more advanced stage, these spots become larger and a powder deposit appears on the sheet. When it is noted, all corrosion must be carefully scraped off and the surface washed with vinegar. These practical measures are far more effective than the most learned and complicated methods of protection against corrosion.

Another advantage of metal construction of floats is that, in running aground or in hitting a log while taxying, bending of the sheets rather than piercing is likely. Even when a dural pontoon sheet has been pierced, repair is easy. The hole is carefully examined for radiating tears or cracks, sufficient material is cut away to leave only sound covering, and a patch somewhat larger than the hole is riveted in place. The repair patch is always of somewhat greater thickness than the original sheet.

During riveting the rivets have to be held firmly on the inside. The illustration shows a typical dural float patch, with typical rivet spacing. The rivets may be set in a manner so as to give them a round head, or peened down flat with a hammer. Both types are equally reliable for watertightness.

A typical repair patch on a duralumin pontoon, showing the placement of the rivets

Requirements of the Modern Airplane

LIEUTENANT-COMMANDER L. B. RICHARDSON, speaking before the Los Angeles section of the Society of Aeronautical Engineers, gave a splendid survey of the requirements of the modern navy plane.

The navy plane must carry heavy ordnance loads; climb fast; fly fast; have great endurance; be light structurally, yet be strong enough to withstand heavy seas in take-off or when moored at buoys; be strong enough to withstand the terrible shock of catapaulting; be able to turn in a short radius; go into a tail-spin easily and come out of its own accord; have sufficient stability to be flown "hands off," yet answer all controls instantly and with precision; have ample space for its crew as well as protection for them in case of a crash; and be re-inforced so that heavy-footed mechanics can climb all over it without damaging it.

As a bomber, the navy plane must have all the instruments for discharging bombs arranged in orderly fashion and readily accessible behind a glass window fitted with a windshield-wiper. It must also carry parachute flares, landing lights, smoke bombs, emergency rations, anchor and line, engine tools and spares. It must have folding wings to allow ready stowage aboard ship and these should be so arranged as to allow rigging for flight in three minutes. When rigged, the total wing-spread must not exceed the dimensions of the elevators used to hoist the airplane to the flying deck of the carrier. The hull of the flying boat must not soak up water when anchored for a whole season, yet, if of metal, it must not corrode.

The power plant offers an equal number of strenuous requirements. The engine must not weigh more than one and three-quarters pounds per horsepower, yet it must be rugged enough to run 300 hours between overhauls without breakdown. The propeller must be thin enough to be light and efficient yet must withstand the attacks of spray and rain. The fuel tanks must be of a material not affected by benzol or ethyl fuel, yet they cannot be of copper or tinned iron because these materials are too heavy. The radiator must be of the lightest possible design, yet leakproof. It is to be located where it will produce the best cooling results, yet not interfere with the pilot's vision. It must not be where it will cause undue air-resistance.

Commander Richardson also gave an interesting list of the experimental problems

(Continued on page 418)

in aviation now engaging the Navy. Floats are being designed which have excellent flotation and take-off qualities, yet offer low resistance when in the air. For very large planes, servo-motors for the operation of the control surfaces were being considered.

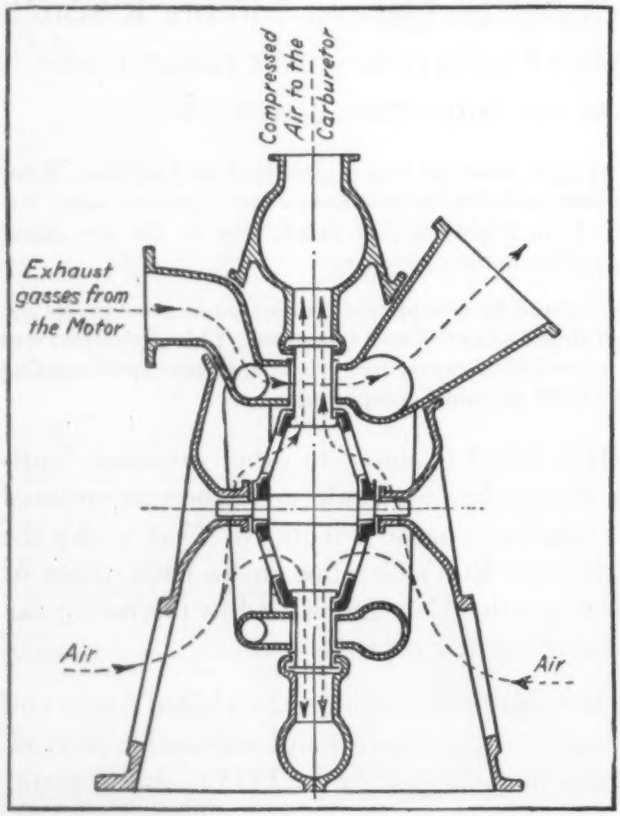
Since duralumin must be used for floats, processes are being developed to prevent its corrosion by sea water. Supercharged engines do not develop their full efficiency without variable-pitch propellers, so that the combination of a supercharged engine and adjustable-pitch propeller is being actively studied. To reduce the excessive air resistance of large water-cooled engines, methods of steam cooling are being examined, the latent heat of steam providing such an excellent medium for the dissipation of large quantities of heat.

We are obliged to the Commander for this interesting and stimulating review of aviation problems and tendencies.

A New Exhaust Turbine

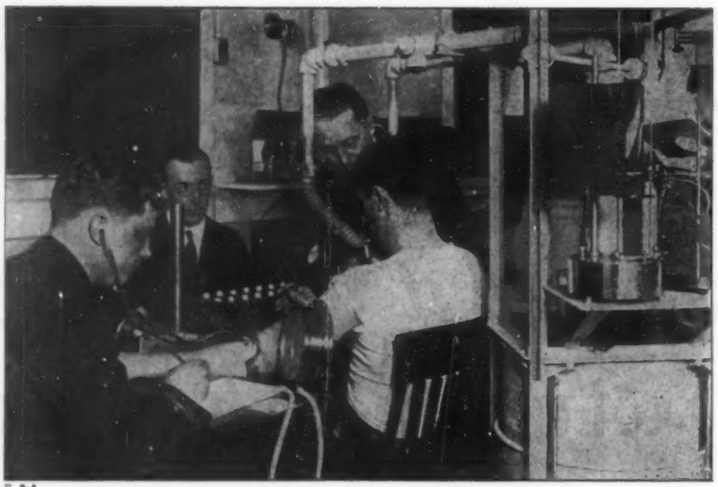
A WRITER in the German publication *Der Motorwagen* describes a new type of exhaust-gas turbine for supercharging aero engines at high altitudes, which offers many interesting features. Hitherto practice in exhaust-gas turbines has involved two rotors: one to be set in motion by the exhaust gases, and the other to be driven by the first rotor and to compress the air prior to entry into the combustion chamber.

In the Lorenzen supercharger, by very ingenious design, the two rotors are combined in one. The exhaust gases strike the rotor blades tangentially and go out through tangential openings. The fresh air, passing through spiral passages, flows through the rotor by way of radial openings, undergoes centrifugal compression, discharges into a circumferential housing and passes on to the carburetor without contamination by the exhaust gases.



In the Lorenzen exhaust-gas turbine, shown in diagrammatic form here, the driving rotor and the compression rotor are combined in one, providing cooling of the blades and greater simplicity than has heretofore been obtained with two rotors

The advantages of the device are many. There is, first of all, greater simplicity and lightness by the elimination of one rotor. Owing to the passage of fresh, cool air the turbine blades never reach a temperature of more than 400 degrees, Centigrade. After 50 hours of running, the rotor shows no trace of burning by the exhaust gases and no signs of wear. By the use of only one rotor the windage losses are halved. Also, owing to the very short distance now possible between the bearings, there is no danger of a critical speed, with corresponding vibration, being reached.



F. & A.

Simulating the low air pressures and small oxygen content of the air at high altitudes, in a physical test of a future naval aviator

Altitude Tests for Aviators

THE effects of altitude on the aviator are insidious. He may become absolutely inefficient and not realize it, and his danger zone may be at a much lower altitude than he thinks it is. It is therefore a part of aviation medicine to determine the ability of an individual to counteract the lack of oxygen.

Three laboratory methods are available. First, there is the low-pressure chamber, a huge steel cylinder controlled by a vacuum pump which forces a constant stream of fresh air through the chamber. By pumping air out faster than it is pumped in, an ascent can be simulated and vice-versa. Any altitude equivalent may be obtained or maintained, but the test is long, and the equipment expensive.

In another type of apparatus, developed by Dreyer, the subject breathes a stream of air in which there is a steadily decreasing percentage of oxygen. The barometric pressure remains constant, but the oxygen percentage is steadily reduced. The apparatus gets out of order easily and it is difficult to obtain absolutely pure oxygen.

The third method, devised by Henderson and Pierce is the "rebreather" method, and is perhaps the cheapest and most convenient form. In this apparatus the subject breathes over and over again the same air with the carbon dioxide removed. He burns up the oxygen, thus constantly reducing its percentage. The apparatus and method of test is shown in one of our photographs. The would-be aviator sits with a clip on his nose and his mouth glued to a mouthpiece. On either side of the large metal tank shown at the right-hand lower corner of the photograph are metal pipes, one being an inspiratory pipe, the other an expiratory pipe. One-way valves prevent the current of air from going in any but the right direction.

In the expiration pipe there is placed a cartridge of dry sodium hydroxide which removes the carbon dioxide from the air. As the carbon dioxide is absorbed and the oxygen burned, water is let into the tank. The amount of water is a measure of the amount of air used in the experiment. While this is going on, the candidate is undergoing psychological tests such as touching with a stylus that lamp of a row of low-power electric lamps which the observer has switched on at any particular instant.

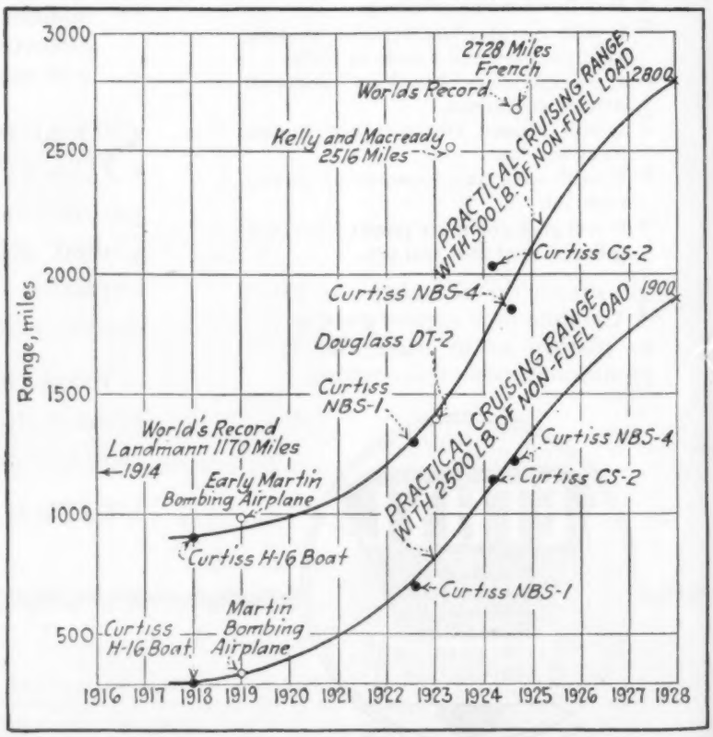
Prediction of Improved Performance

LIGHTER engines for the same power, aerodynamically cleaner planes and lighter structures with the same strength all lead to the possibility of greater ranges of airplane flight together with the carrying of real pay loads. Arthur Nutt, in the *Society of Automotive Engineers Journal*, presents, among other interesting predictions, a chart of what may soon be expected along these lines. An endurance record of 45 hours, 11 minutes has been made in France, but in this case, no pay or commercial load was carried. However, at the present time, nearly 13 hours of flight and a range of something like 1,300 miles is possible with a pay load of 2,500 pounds. By 1928 Mr. Nutt expects a flying range of 1,900 miles with a pay load of about 2,500 pounds. A non-stop, commercially-profitable run from New York to San Francisco looms in the not far-distant horizon.

The Acoustic Height-Indicator

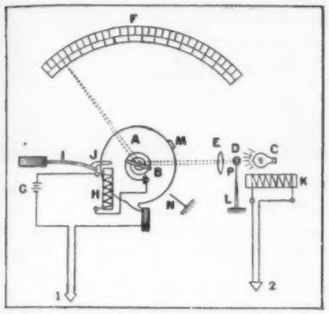
WE have had occasion to refer to the utility and general principles of operation of the Behm acoustic height-indicator, which, being independent of barometric conditions, is of so much help in airship navigation. Thanks to the courtesy of the French periodical *L'Illustration*, we can now give an explanatory diagram of this ingenious device, in which height above ground is measured by the rapidity of return from the ground to the airship of a projected sound wave.

The disk, A, when rotating, carries with it a mirror, B, which reflects the concen-



These curves show past performances with pay loads of 500 to 2,500 pounds. The curves end in predicted ranges for 1928. Practical commercial aviation depends to a great extent on the realization of this prophecy

trated rays of the lamp, C, on a graduated scale, F. When the sound wave (produced by firing a blank cartridge) moves the microphone, 1, the variation in current in the circuit in which are placed the batteries, G, releases the spur, J, from the electro-magnet, H. The spring, I, then gives the spur, J, a "kick" and the disk, A, is set into rotation. The ray of light then begins its travel on the graduated scale, F. When the echo of the sound returns from earth or sea, it strikes the microphone, 2, and causes a variation in the current of the coil surrounding the electro-magnet, K. This jerks aside the little glass bulb, D (the magnet



A diagram of the Behm acoustic height-indicator described in the text

should really appear in end view in our diagram), and the effect is at once noticeable on the scale, F. With suitable calibration, the observer can tell the height by the length of travel along F. Incidentally, when the spur, M, touches the spring, N, this spring sends the rotating disk, A, back to its original position; H catches the spur, J, again and the instrument is ready for another sounding. For the sake of accuracy several soundings may be advisable.

Civilian Flyers Set New Endurance Record

FLYING a Bellanca monoplane, motored with a Wright Whirlwind air-cooled engine, two American civilian aviators recently set a new record for endurance flying, overcoming by a wide margin the French record of 45 hours, 11 minutes and 59 seconds that was made in 1925 by two French army officers. The two Americans who performed this remarkable feat are Clarence D. Chamberlin and Bert Acosta, and their time in the air was 51 hours, 11 minutes and 25 seconds.

When the aviators took off from Roosevelt Field, Long Island, the monoplane carried a useful load of 3,080 pounds. Even with this enormous weight, no difficulty was experienced, the take-off being made after a run of only 1,200 feet. This was accomplished at 9:30:40 on a Tuesday morning and from then until 12:41:5 on the following Thursday afternoon, the plane droned steadily over the peaceful countryside. At 12:37 on Thursday afternoon, the steady hum of the motor stopped and the plane started on its long, steady glide to the ground, touching at exactly the time mentioned. The entire flight was made near the starting field, with occasional flights out over the ocean.

When starting for the record-breaking flight, the monoplane carried 385 gallons of gasoline, enough to last for a period of 52 hours, according to the plane's designer, Giuseppe M. Bellanca. His estimate was not far wrong.

This same plane, with a similar engine, may attempt a New York-to-Paris flight sometime in the very near future.

A Shipboard Fighter

PRIOR to competitive tests at Anacostia, D. C., the Curtiss-Navy shipboard fighter, *F7C-1*, underwent a remarkable series of flights at Mitchel Field, Garden City, Long Island. It showed a remarkable burst of speed, perhaps the greatest ever attained by a plane equipped with an air-cooled engine, performed every possible maneuver in the air, and in particular, actually climbed when in an inverted position.

Courtesy of Curtiss Aeroplane and Motor Company, Inc.

The Curtiss-Navy shipboard fighter, said to be one of the fastest planes in the world equipped with an air-cooled engine

There is no theoretical reason why a plane should not fly horizontally or climb when on its back; but when in such a position, the wings produce a lift in a direction contrary from the customary one, and are therefore quite inefficient. Because of this, it has been considered hitherto that inverted climb was an impossibility. But, a combination of light structure, powerful and light power plant, and excellent aerodynamic characteristics made possible the achievement of this apparent impossibility!

The plane is ideal from a fighting point of view, and is armed with two .30-caliber machine guns, discharging 600 shots a minute. But it also incorporates many features which are of interest to aviation in general.

The plane is to operate from the deck of an aircraft carrier, or to be catapaulted from the turret of a warship. But it must also land on the deck of an airship carrier. Hence a very short landing run is desirable. To achieve this, the wheels are equipped with hydraulic brakes—used for the first time in airplane practice—and with oleo shock absorbers, in which the vertical shock of landing is taken up by the resistance to the flow of oil passing through a very narrow orifice. Both these devices are embodied in the wheel itself, which is a feat of skilful mechanical design. Much importance has hitherto been attached to the arresting devices placed on board an aircraft carrier, whose design has been kept jealously secret by the Navy. With the incorporation of powerful brakes, special deck arresters may ultimately be dispensed with.

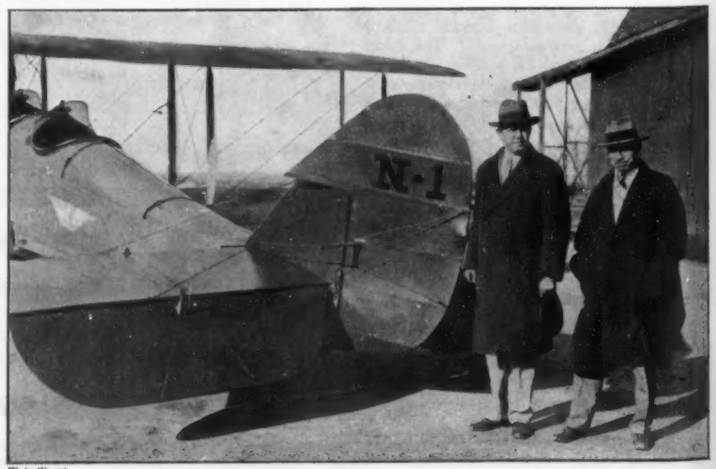
To diminish fire hazard, a "dump-valve" is located in the bottom of the gasoline tank. The pilot can open this valve at will, and in a few seconds drop overboard the entire gasoline content of the plane. Additional safety is provided by keeping all fuel piping out of the pilot's cockpit. Another precaution is in the form of a pressure fire extinguisher, carried in the engine compartment, ready to spray the whole compartment with pyrene at the turn of a valve.

In modern airplanes, the comfort of the pilot is being taken into consideration to a high degree. Even in the highest priced automobiles, no easy adjustment is provided for the foot pedals. The driver, be he short- or long-legged, must use them as he finds them. On the *F7C-1*, the foot pedals operate on slides, and can be moved forward or backward by means of a hand lever. On getting into the seat, the pilot adjusts the pedals to suit his individual requirements, and locks them in that position. The seat, too, is adjustable, sliding up or down to give the pilot any degree of vision required. Furthermore, the pedals slide back or forth as the seat is raised or lowered, thus keeping their adjustment constant.

Many of these desirable features are certain to be followed in commercial craft as time goes on.

Air Regulations

THE new Aeronautics Branch of the Department of Commerce has air regulation as perhaps its most important function. A small pamphlet entitled "Air Commerce Regulations" is available on request and covers the licensing of aircraft, the marking of aircraft, the operation of aircraft, the licensing of pilots and mechanics, and air traffic rules. The comprehensive duties that this pamphlet outline fall on the new Assistant Secretary William P. McCracken, Jr., and on Clarence M. Young, Chief of the Air Regulations Division. In our photograph, these two gentlemen are shown inspecting airplane Number 1, the first aircraft licensed and registered under the new act, and displaying the identification mark on the rudder.



Wide World

The first plane registered and licensed under the new air regulations. The number on the rudder indicates this fact

In the World of Chemistry

A Department Devoted to the Advancements Made in Industrial and Experimental Chemistry

Conducted by D. H. Killeffer

Alcohol for Chemical Burns

WORD comes from Germany that pure, highly-concentrated alcohol is extremely efficient in the treatment of burns from chemicals. Felix Fritz in a recent issue of *Farbenzeitung* recommends that highly concentrated, preferably absolute, chemically-pure alcohol be kept on hand in chemical plants, in amounts of several liters, especially for the purpose. For example, if the hand is burned, it is plunged into a suitable amount of alcohol in a clean porcelain dish, or a piece of bandage, dripping wet with alcohol, is applied to the affected part. The quicker the case is treated, the more effective is the remedy. Blisters never develop. Even in the case of sulfuric acid burns or those from hydrofluoric acid, the alcohol treatment is said to have proved effective. On the other hand, the inflammability of alcohol must be given consideration as an objection and recourse may be had to other remedies, as for example, strong silver nitrate or perhaps zinc chloride.

The Motor-fuel Problem

AT the Massachusetts Institute of Technology there was recently held a symposium on the subject of gasoline by the Northeastern Section of the American Chemical Society. At this symposium a number of extremely interesting and important facts bearing upon the American motor-fuel problem were brought out. The importance of a careful study of motor fuels and methods of increasing the efficiency of our present methods of utilizing them was emphasized by Mr. T. A. Boyd of the Research Laboratories of the General Motors Corporation when he stated that the amount of energy contained in the gasoline burned in American automobiles is equivalent to about 15 times that generated by Niagara Falls and only about 5 percent of this actually is used to drive the cars along. In other words, we are pouring into our automobiles the energy of 15 Niagaras and are getting back less useful work than only one could produce.

Cracking processes now in operation make it practical to secure from many crude oils as much as 40 to 70 percent gasoline, according to Prof. W. K. Lewis of Massachusetts Institute of Technology, in discussing the influence of refinery methods on possible increased supplies of gasoline. Continuing, Prof. Lewis said:

"There is no question but what the gasoline yield from the crude can be increased to a point far above its present value the moment it is economically advisable to do so. It must, however, be kept in mind that the further cracking is carried, the more difficult and therefore the more expensive the operation becomes. In other words, there is an economic balance beyond which cracking does not pay, but the higher the price of gasoline, the further cracking can be forced. These cracking operations represent, therefore, an insurance against inadequate gasoline supply as our crude resources begin to fail and offer a potential method of petroleum conservation which will come into more active operation the moment the economic situation justifies their more intensive use."

"The thing that happens to the fuel and air in the fiery stomach of the gasoline engine is just as much of a chemical reaction," said Mr. Boyd in his discussion of the gasoline engine as a converter of chemical energy, "as the making of T.N.T. or the synthesis of a beautiful dye. The strange thing about this combustion reaction is that chemists have not laid a stronger claim to it, and made greater efforts to understand it better. There is probably no reaction in the world that means more to society than this one does. . . .

"The chemical manufacturer always uses some means of controlling what happens in his reaction vats, and especially does he regulate the speed of the reaction that he is working with. Everyone knows what happens when the maker of T.N.T. lets the reaction run away from him. The explosive manufacturer knows a number of ways of controlling the rate of the chemical reaction that he conducts in his vats and he uses every one of them.

"But the only means the automobile driver has to regulate the reaction that goes on in the engine of his car is the throttle. And the throttle does not control the *rate* or the *course* of reaction at all. It just regulates the *amount* of reaction by feeding larger or smaller portions of gasoline and air to the engine."

In concluding his remarks, Mr. Boyd entered a strong plea for cooperation in the study of the little understood phenomena of combustion.

The phenomenon of knock was discussed by Dr. Graham Edgar, of the Ethyl Gasoline Corporation, who pointed out that we do not yet understand either the nature or the causes of the loss of power in internal combustion engines due to knock. Although empirical methods have been found which successfully reduce knock, no one yet knows why or how these operate. The data on the subject, according to Dr. Edgar, are inconclusive, yet a solution of the problem already forecast by anti-knock fuels now in use would undoubtedly lead to a saving of as much as 30 percent of our gasoline.

The manufacturing cost of synthetic gasolines, according to Dr. A. C. Fieldner of the United States Bureau of Mines, in discussing the obtaining of motor fuel from coal, is too high to permit any of the present synthetic products from competing with petroleum gasoline until the price of the latter at the refinery rises to 30 or 40 cents a gallon. Dr. Fieldner analyzed the costs of production of gasoline by the Bergius process as now practiced in Germany, the Patart process for producing methanol now used in France and the Fisher process for the production of "synthol." He found that the cost of applying these three processes in the United States would be equivalent to 40 to 50 cents a gallon for Bergius gasoline, 31 cents a gallon for methanol (equivalent to gasoline at 60 cents a gallon on an energy basis) and that data on the Fisher process are still insufficient to form the basis of sound estimates.

Synthetic Perfumes and Flavors

IN 1925, 2,370,728 pounds of coal-tar derivatives made in the United States were sold to perfumery manufacturers for 883,617 dollars and 2,148,904 pounds of synthetic flavors were sold for 1,409,311 dollars. This compares with the extremely small figures which represented the industry before the war, when all such materials were imported.

Manganese in Plant Growth

FERTILIZERS as ordinarily used consist of three essentials, nitrogen, potash and phosphates. However, recent investigations by the Bureau of Plant Industry at Washington, D. C., lead to the belief that manganese, although required in smaller quantities than other fertilizer constituents, must be given to plants to promote normal

growth. Most soils contain a sufficient amount of manganese to render further additions unnecessary but the increasing intensive use of our soils is depleting them in this respect.

"Hence," state Schriener and Dawson in reporting the results of a recent investigation in *Industrial and Engineering Chemistry*, "future fertilizer practice must take into consideration the role of manganese and other elements which may be proved indispensable to plant growth and function; provision must be made for determining deficiencies where they occur and meeting them through appropriate supplements to the fertilizers applied. At the same time, it should be emphasized that the amounts of the constituents required are exceedingly small and that precautions must be exercised to prevent risk of toxic effects from excessive applications or from applications to soils and addition to fertilizers already supplying amounts sufficient for plant requirements."

Paper Weed-Killers

COARSE paper may be used as a mulch for growing crops to prevent the growth of weeds which sap the fertility of the soil. In Hawaii, this method of preventing the growth of weeds in sugar-cane fields has been in successful use for a number of years, the yield of cane being greatly increased by the use of paper made from sugar-mill waste. Word now comes from South Africa of similar success there. In a recent issue of *Pulp and Paper Magazine* of Canada we read:

"The Elsenburg School of Agriculture (South Africa) has been using paper mulch for summer crops. The mulching paper consists of a light brown, coarse paper, impregnated with asphalt. It was supplied in rolls, three feet wide. The paper was rolled out into rows, and the plants and seeds were planted along the center of the paper by piercing holes through it. The two edges of the paper were covered with a layer of soil to prevent it from blowing away. Plants and seeds were watered in the usual way.

"As a result of the trials, it has been found that paper mulch, as it is called, produces better tomatoes, kale, and plants than Mother Earth. The school has now circulated a memorandum to all gardeners and farmers stating that the brown paper is effective in checking weed growth, and will be most useful in vegetable gardening or small fruit culture, but not in ordinary farming."

Bi-Fluid Boilers

ABOUT two years ago much interest was aroused by the increased efficiency of a boiler plant using mercury vapor to operate a turbine and condensing the mercury in a steam boiler. A plant thus operated showed considerably higher efficiency than one using steam alone, presumably because of the wider range of operating temperatures. However, the high cost of mercury (at present about $1.35 a pound) made the investment in such a plant unusually high. Now the announcement is made that diphenyl oxide will serve quite as well as mercury and at much less cost. By operating the diphenyl-oxide boiler at a pressure of 200 pounds per square inch and a temperature of 800 degrees, Fahrenheit, and by using a steam boiler as a condenser, very high efficiencies, fully equal to those obtained with mercury, can be realized. Diphenyl oxide can be had for 30 cents a pound in large quantity, according to H. H. Dow of Midland, Michigan, which makes its cost, volume for volume, less than 2 percent of that of mercury. It has been used hitherto only in perfumes, because of its geranium-like odor, but the prospect of using it in large quantities for power production will not offer unusual difficulties in manufacturing.

The increased efficiency of a bi-fluid boiler, whether using mercury or diphenyl oxide, is a result of the wider temperature-range over which the machine may be operated and is not inherent in the material used. Mercury vapor is extremely poisonous even in very small doses and this, coupled with its much higher cost, has prevented the wide adoption of it as a boiler liquid. It seems probable that cheap, non-poisonous diphenyl will avoid these difficulties to a very large extent and tend to popularize this kind of power production.

Steam as an Anti-Knock

A LETTER from W. H. Giltner, written as a result of reading remarks on this page in the March issue, brings to attention the doubtful value of steam or water vapor in making an automobile engine operate smoothly. Mr. Giltner sends us a copy of his patent on a device for introducing water vapor into the carbureter and says:

"I have read with much interest your article on 'Anti-Knock Fuels for Motors,' which appears on page 200 of the March, 1927, issue of the Scientific American.

"I have made some experiments along this line and you might be interested in the results obtained.

"My efforts have been along the line of converting water into steam by the exhaust heat, and drawing said steam along with the fuel mixture through the air intake of the carbureter.

"The steam mixes with the fuel, eliminates the carbon knock entirely, increases the fuel efficiency to the extent of one-third, eliminates a large part of the carbon deposit and maintains a uniform working temperature in the motor, thereby taking the place of hot-spot manifolds and other devices designed to heat the fuel.

"The proportion of water thus used is about one to four or say one gallon of water to four of gasoline.

"I have had one of these in continuous use for the past 12 months with results as above stated and with no ill effects to motor and no repairs on same. Have made economy tests from time to time and get from 14 to 16 miles per gallon without steam and from 24 to 26 miles with steam. The device operates entirely automatically, requiring no attention except as to the water supply. Would appreciate your opinion as to the use of steam as an anti-knock and economic agent."

It is very difficult to form an opinion of any great value on such incomplete data as this. The use of steam in internal-combustion engines is not new, but has been tried and abandoned by a great many experimenters. The records of these trials are difficult to locate as most of them have been failures and people do not like to flaunt their mistakes before the world. In discussing the question with a number of competent automotive engineers, I am told that the effect produced is probably the result of simple dilution of the gas mixture by the water vapor and that almost identical results may be obtained by using nitrogen or some other inert gas, instead of steam. It is also possible that the steam has some effect on the cylinder reaction. The admission to the cylinder of larger proportions of air with respect to the fuel will not do exactly the same thing but dilution of the mixture tends to produce a slower reaction and hence less knocking if its oxygen content is thereby proportionately diminished. It is quite probable that a large part of the economy obtained by Mr. Giltner could be accounted for by a simple readjustment of his carbureter.

A New Paint Remover

THE waste liquors from the manufacture of paper pulp by the sulfite process have long presented a serious problem in waste utilization. A recent announcement from the Bureau of Chemistry states that Max Phillips and M. J. Goss, chemists of the Bureau of Chemistry, have devised and patented a new and very effective paint remover based upon para cymene, obtained from an oil recovered from the waste of sulfite paper mills.

The oil from which the new paint and

varnish remover is made was, until recently, almost wholly an economic waste. It has been variously estimated that from 750,000 to 2,000,000 gallons of this material are annually produced in the sulfite pulp mills of the United States. The paint and varnish remover is prepared by mixing para cymene with grain alcohol, methanol, and acetone, in equal parts by volume.

The most effective method for removing paint and varnish is to apply the new remover to the surface to be treated. After three to five minutes the softened paint or varnish may be very easily removed by means of a scraper.

Using Powdered Iron Ore

THE use of ores of iron in finely divided form in blast furnaces is, by their very nature, impossible and many efforts have been made to find a way of agglomerating fine material containing much iron into a form suitable for such use. Among the sources yielding a rich ore of iron in powdered form has been the burning of iron pyrites to form sulfur dioxide, used in the manufacture of sulfuric acid.

Recent word from Italy states that the problem of converting this hitherto useless iron ore into shape for blast-furnace use has been solved by the process of Piccinini. The pyrites ashes are mixed with a little coal, and spread upon large uncovered squares. The combustion is stimulated with a slow current of air. As a consequence of this treatment, an automatic agglomeration takes place. The iron percentage is raised with a reduction in the sulfur of the ashes. The process is very economical and small plants can apply it. So successful has this process proved in preliminary tests that a recent government decree now forbids the exportation of pyrites ashes from Italy.

Foreign Trade in Chemicals

DURING the year 1926 the United States imported 134,735,000 dollars' worth of chemical and allied products. Against this stands the export figure of 124,836,000 dollars.

Enamels on Iron

A WIDER variety of vitreous enamels for application to sheet iron and steel for the manufacture of enameled kitchen ware is being sought by the Bureau of Standards. The types of enamels now available are too limited for the many diverse uses to which they are put and the Bureau has been seeking new mixtures.

The effects produced by the substitution of various constituents commonly used in enamels, one for another, were studied with reference to the resistance of the enamels to failure when subjected to mechanical impact and sudden temperature changes. In general, the ingredients which improved most in resistance to the test treatment were flint and sodium oxide. Boric oxide favorably influenced resistance to mechanical impact in one type of composition. Thermal expansion played a much less conspicuous part in the resistance of first coats than of second coats to the test treatments.

American Synthetic Methanol

THE first American manufacture of synthetic methanol (wood alcohol) is under way on a commercial scale at Belle, near Charleston, West Virginia, where a plant is being operated by Lazote, Inc., affiliated with the du Pont Company, according to an announcement recently made by the latter company. The announcement continues:

"Two years of intensive research and experimental work have resulted in the development of a new and purely American process, radically different from and an improvement over the foreign processes which, a few years ago, started to revolutionize the wood-distillation industry. For several years there has been great interest in the possible development of methanol in this country and it has been expected that American producers would operate under the French or German patents. The fact that this new process is all-American has attracted as much attention as has the opening of the plant itself.

"Methanol is chemically the same as pure wood alcohol and is available for use as a solvent and in the various manufacturing industries which require it. Dyestuffs, lacquers, celluloid, bakelite and other synthetic resins use it in large quantities, the American demand alone being about 6,000,000 gallons a year.

"The new plant, operated in conjunction with Lazote's synthetic ammonia manufacture, produces methanol from carbon monoxide and hydrogen under enormous pressures and at high temperatures. The commercial units now in production were built after an experimental plant had been operated satisfactorily for six months. The operations have been so successful that plans have been drawn to allow for plant expansion sufficient to meet the entire American demand for methanol."

The effect of this on the American wood-distillation industry is still problematical, but that it will have a serious effect is scarcely to be doubted. The products of the distillation of hard wood are acetic acid, methanol, acetone, charcoal and wood creosote or tar. The first two of these are now being made synthetically and cheaper than the wood-distillation industry has been accustomed to produce them. Acetone is being made by the fermentation of corn in immense quantities and at very low prices as a by-product of the manufacture of butanol. Charcoal, which formerly was extensively used in the iron industry, is no longer in active demand and most of the purposes served by wood tar are being met by coal-tar derivatives. In this situation, the wood-distillation industry is not to be envied.

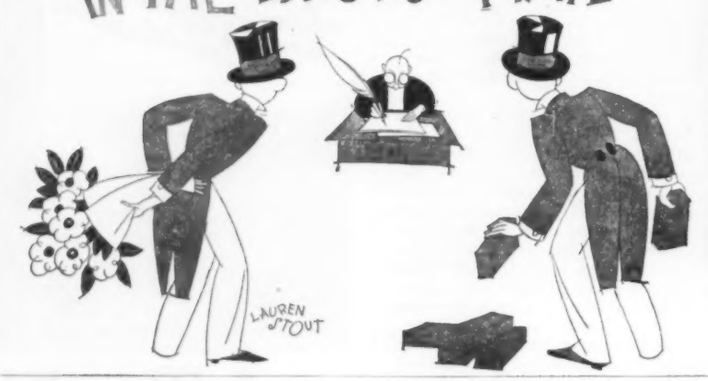
Laboratory First Aid

THROUGH the cooperation of the College of the City of New York, Dr. Alexander O. Gettler, toxicologist for the Medical Examiner's Office of New York City and the Fisher Scientific Company of Pittsburgh, Pennsylvania, the latter company has issued a chart giving in concise form the first aid treatments to be administered for the various accidents likely to occur in chemical laboratories. This chart is arranged to be hung conveniently on the laboratory wall so that prompt measures of the proper kind can be taken in case of accident. Not only are the ordinary first-aid methods as applied to ordinary accidents noted, but also treatments for various types of poisoning which might puzzle even the practicing physician. In this way it is hoped that the data given may be of real service in relieving the victims of laboratory accidents. Copies of the chart are available without charge to any bona fide laboratory on request to the Fisher Scientific Company.

Amyl Acetate from Natural Gasoline

THE comic strips have made banana oil famous, but the lacquer industry has made it important and the recent announcement of a new method for the preparation of amyl acetate from natural gasoline is attracting considerable attention. The results of a careful study of the possibilities of making it from natural gasoline have recently been published in *Industrial and Engineering Chemistry* by George T. Koch and George A. Burrell of Pittsburgh. These investigators, working for the Ohio Fuel Supply Company, have found that amyl acetate can be profitably manufactured from the pentane of natural gasoline by chlorinating this to amyl chloride and causing the latter to react with sodium acetate. The first operation is to distill the natural gasoline carefully to separate as nearly pure pentane as possible. The pentane is then treated with chlorine in the presence of activated charcoal and is thus converted in part to amyl chloride. By heating the amyl chloride with pulverized sodium acetate under pressure, amyl acetate is obtained. According to the calculations of these investigators, a small plant, producing only 480 gallons per day, should be able to make a reasonable profit on the investment.

IN THE EDITOR'S MAIL



Enthusiasts Keep the World Going

An amateur telescope-maker in Wellesley, Massachusetts, has just finished an interesting telescope of the "Springfield" type in which the observer always looks down into the eyepiece as if using a microscope, instead of twisting his neck into the uncomfortable positions often dictated by the "anatomy" of the ordinary conventional type of telescope. The maker of the telescope, which is shown in these columns, does not wish his name published. However, the telescope editor knows him personally and knows what a lot of fun he has had since he became inoculated with the "astronomical bacillus." Here is what he writes:

Telescope Editor, Scientific American:

Early last July, I had the pleasure of meeting you at Springfield, Vermont, where so many amateur astronomers enjoyed the week-end hospitality of the "Telescope Makers of Springfield." I feel that I must offer you my personal thanks for starting this interesting work amongst the amateurs. You have given me lots of fun.

I made a six-inch telescope of the Springfield type, which from my point of view is a great success. My mirror was ground and polished on a very simple automatic machine which any amateur could make in a day. The pitch lap is continuously immersed in the fluid abrasive. I will show it to anyone who is interested. [Editor's note: letters will be forwarded.]

At present I am finishing a quartz mirror to take the place of my glass one.

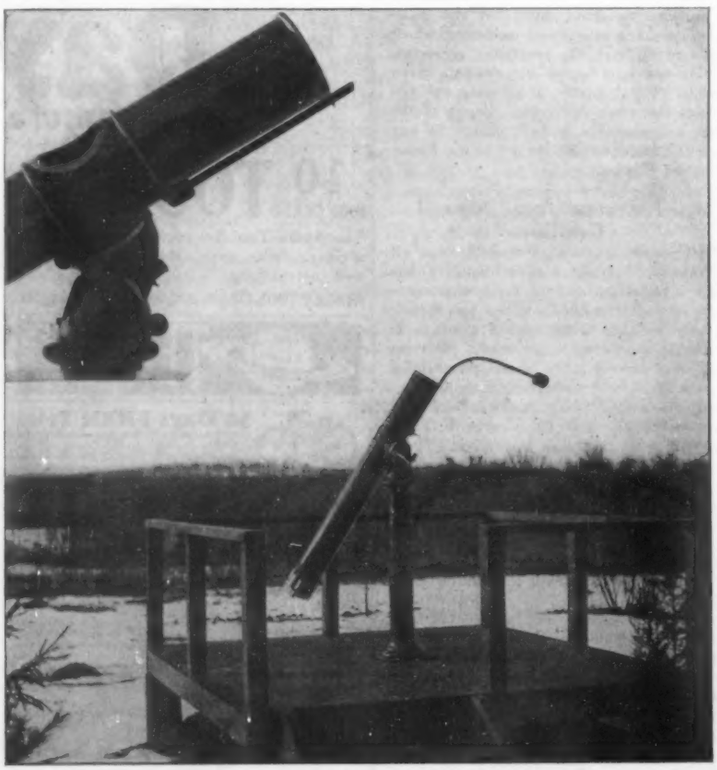
I enclose a photograph of my telescope, with a few slight modifications of Mr. Porter's original design. One end of the tube is extended for attaching a sight which takes the place of a finder; also to add stiffness to the arm of the counterweight. A hand-hole is provided at the side for getting at the prism for adjustment and cleaning. The slow movements are operated by worms and worm gears. The foundation is of concrete and is entirely out of contact with the wooden platform.

When not in use, the mirror is removed and kept in a desiccator, over calcium chloride, and the rest of the instrument is completely covered with a long waterproof canvas bag.

"A Wellesley Enthusiast."

The Einstein Theory

In all the amateur scientist's repertoire there is hardly a subject which so surely starts argument as does relativity. The following letter is in reply to one which was



A Wellesley, Massachusetts, enthusiast made this reflecting telescope. The details of the axes show best in the inserted picture

published in the December issue of the Scientific American, page 472.

Editor, Scientific American:

Being a fellow amateur in pursuit of the elusive theory of relativity, I was greatly interested in the analogy presented by Mr. James O. G. Gibbons, in the December, 1926, issue. At first glance the analogy is attractive because it seems to simplify a very abstruse concept. However, I do not think that it removes the intellectual difficulty inherent in the basic idea of relativity—the constant velocity of light. I will try to make clear some of my objections to the analogy.

The suggestions made by Mr. Gibbons revolve about an assumed inability to measure the true speed of light. He believes that we never can become aware of speeds that are more than half the velocity of light. He believes that the constant velocity of light is an illusion that would disappear if we could really measure that velocity. Thus a great mental hazard of relativity is removed, and all is well with the puzzled layman and his classical mechanics. But, instead of making it clearer, as he intended, Mr. Gibbons really demolishes the whole theory of relativity. I hasten, therefore, to defend this great mental intoxicant, and to preserve it for future generations of addicts.

As a purely mathematical theory, relativity assumes an imaginary, fundamental velocity (c), which has the unique property of constancy for all observers and all reference frames, regardless of their motion. Upon this hypothesis the whole mathematical theory can be built up, and a theoretical structure formed, which unifies many physical conceptions. Also, this constant velocity appears as a limiting value, beyond which no velocity is possible.

So far, the theory is a mathematical abstraction, independent of the actual conditions of the world. The velocity (c) may be *any* velocity, so long as it is universally constant and is a limiting value. If, however, there is found in the real world a velocity which has this very remarkable property, then we have the fundamental reality that blows the breath of life into the whole structure of relativity.

Now, actual physical experiment (the Michelson-Morley experiment) proves that there is a real velocity which has the constancy required in the mathematical theory. This is the velocity of light. We therefore substitute this velocity for the constant (c), and derive the physical results of relativity. These results have been verified by astrophysical observation, and so have gained scientific acceptance for the theory of relativity.

The beauty of the theory lies in the fact that it greatly reduces the number of basic concepts necessary to derive the great laws of physics, and that it effects a wonderful synthesis of such seemingly diverse phenomena as mass, motion, energy, gravitation and electro-magnetics.

In attempting to make the constant velocity of light more comprehensible, Mr. Gibbons introduces yet another concept which makes the world still more mysterious and mars the unity of the theory. He assumes that there is some strange quality of our world that limits velocity perception to speeds of less than half that of light. Thus light itself actually travels two or more times faster than we can perceive it. This mysterious world properly introduces an entirely new view, which is impossible of verification. But on its assumption, it is shown that both the constancy and limiting quality of light velocity are only apparent and not real.

In denying these properties of constancy and limit, Mr. Gibbons attacks the very foundations of relativity. We have seen that they are fundamental and that the generalizations of the theory cannot be built up on any other basis. It is not the actual speed of light that is important to the student of relativity. If Mr. Gibbons assures him that the value, 372,000 miles per second, is constant and limiting, he would accept this value tentatively, and subject the new results to experiment. But if Mr. Gibbons says the value is neither constant nor limiting, the relativist has no use for it. And Mr. Gibbons necessarily makes this latter statement, else the same old problem of constancy creeps back into his analogy.

We must, therefore, reject the analogy as contrary to the fundamentals of relativity. The mental difficulties that plague the layman cannot be removed in this way. If we accept the theory we must also accept the constancy of light velocity, with all its seeming paradoxes. Perhaps the habit of mind with which the layman approaches the theory is inadequate for a clear grasp of its problems. Perhaps we must acquire a new way of thinking, before "constant velocity," "curved space" and all the other magic phrases have any concrete significance for our minds.

D. Horwich,
Chicago, Illinois.

Where Is the Strongest Artesian Well?

One of our readers, a member of the United States Geological Survey, sends some interesting facts regarding artesian wells. Possibly some of our other readers can supplement this data with authentic details of other wells that will displace the champion put up by Mr. Meinzer.

Editor, Scientific American:

I wish to raise the question as to what is the strongest artesian well that has ever been drilled. In other words, what and where is the well that holds the world's record in the number of gallons a minute that it discharges or has in the past discharged by artesian pressure? I have not made any thorough investigation of this subject, but in order to get something started I will give the recorded flow of a few of the strongest wells that have come to my attention. If anyone knows of a still stronger well, I would be glad to hear about it so that the true world's champion may be located and duly credited. Following are the records of what appear to be some of the leading ones:

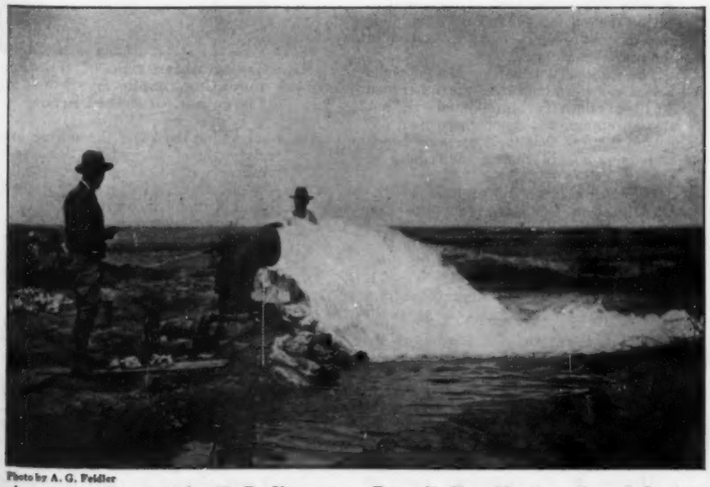


Photo by A. G. Fiedler

Artesian well owned by H. D. King, near Roswell, New Mexico. It was flowing at a rate of 3,190 gallons a minute when this photograph was taken

In the state of Queensland, in Australia, is the so-called Tinderry bore, which is a six-inch well drilled in 1910 to a depth of 2,500 feet. According to a report by J. B. Henderson, the State hydraulic engineer,[1] this well when completed had an artesian pressure of 162 to 183 pounds to the square inch and flowed 2,520 gallons a minute. Thirty-eight other wells in Queensland were, in 1911, reported to have artesian flows of more than 2,500,000 gallons a day (about 1,700 gallons a minute), and one was reported with a doubtful record of 4,500,000 gallons a day (about 3,125 gallons a minute).

A number of strong flowing wells were drilled many years ago near San Bernardino, California, for the Gage Canal Company. The strongest of these, as reported by J. B. Lippincott,[2] was a 10-inch well that was drilled to a depth of 192 feet and flowed 3,730 gallons a minute. A few other wells in the same vicinity flowed nearly as much. The head is not definitely known but was apparently about 40 pounds.

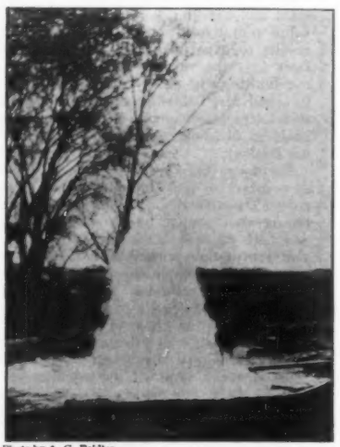


Photo by A. G. Fiedler

Another artesian well in New Mexico, which was delivering water at a rate of 5,710 gallons a minute when this picture was taken

In 1896, N. H. Darton[3] reported an 8-inch well at Chamberlain, South Dakota, which was 685 feet deep, had an artesian pressure of 110 pounds, and flowed 4,350 gallons a minute. He reported four other wells in the Dakota artesian basin that flowed 3,000 gallons a minute or more.

In March, 1926, a 12½-inch well, 780 feet deep, was drilled for the Oasis Cotton Company, near Roswell, New Mexico. On April 21, 1926, A. G. Fiedler, of the United States Geological Survey, examined this well. He found that the artesian pressure was only about 32 pounds but that the flow, according to a careful measurement made by him, was 5,710 gallons a minute. He further estimated that when the well was completed it flowed about 5,900 gallons a minute. Thus the New Mexico well is easily the champion among these four record wells which I have described in the above paragraphs.

The California and New Mexico wells had some advantage over the other two in their relatively large diameters, but this advantage was much more than offset by the fact that their pressure heads were very much smaller than those of the others.

I am sending a photograph of the Oasis Cotton Company well, and also one of the well of H. D. King, near Roswell, New Mexico, which had a flow of 3,190 gallons a minute. Both of these photographs were taken by Mr. Fiedler. Enlargements of them were placed on exhibit at the Sesquicentennial Exposition in Philadelphia.

Oscar E. Meinzer,
Geologist in charge,
Division of Ground Water,
United States Geological Survey.

[1] Twenty-second Annual Report of the Hydraulic Engineer of Queensland, 1911. Page 5, and pages 3 and 19 in the appended table of bores; also appended diagram Number 225.

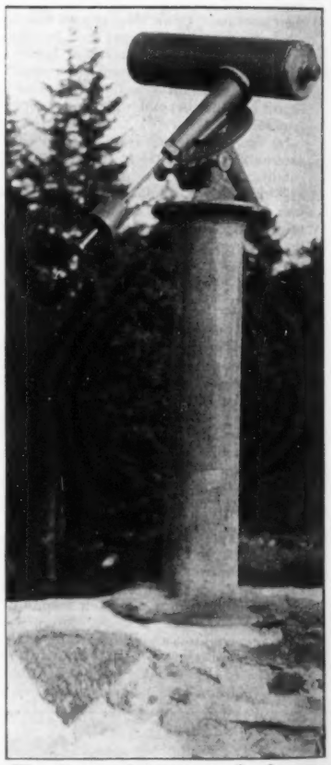
[2] Lippincott, J. B., Development and application of water near San Bernardino, Colton, and Riverside, California, Part II: United States Geological Survey, Water-Supply Paper 60, page 126, 1902.

[3] Darton, N. H., Preliminary report on artesian waters of a portion of the Dakotas: United States Geological Survey, 17th Annual Report, 1896, pages 609 and 645.

Amateur Enthusiast Makes Compact Telescope

The Scientific American, in conducting a campaign for encouraging mechanically inclined amateurs to make their own reflecting telescopes, has stuck to what is known as the Newtonian style of mounting, in which the cone of reflected rays is turned at right angles and brought into an eyepiece on the side of the telescope tube. There is, however, another type of reflecting telescope in which the cone of reflected rays is turned directly back at the concave mirror, through which a central hole is cut to permit the rays to pass and reach the eyepiece. This is the Cassegrainian type. Such a telescope, with a four-inch mirror, has been constructed by Mr. John M. Pierce, of the "Telescope Makers of Springfield," who is now perfecting a larger telescope of the same type. Mr. Pierce writes:

"This little instrument has a four-inch mirror with a one-inch hole in its center. The secondary mirror is one inch in diameter. In the Cassegrainian telescope, the secondary or convex mirror decreases the angle of the cone of rays, giving an equivalent focal length several times that of the speculum. In this particular telescope the mirror has a focal length of 22 inches; the secondary mirror was so planned as to multiply this by three, giving an equivalent focal length of 66 inches.



The Cassegrainian type of telescope and mounting made by John M. Pierce and described here

"The mirror was parabolized very carefully, but no attempt was made to figure the convex (spherical) mirror, which has an 18-inch radius. The instrument works best with a three-quarter-inch eyepiece, which gives a magnification of about 100 diameters. The beauty of the Cassegrainian is the great power of the instrument, with compactness. The little telescope is only 18 inches long, while a Newtonian of the same focal length would be six feet long. The distance from mirror to secondary mirror is 16 inches.

"The mounting shown in the photograph was planned to carry later a 12-inch Cassegrainian-Newtonian combination which I am now completing."

Radio Notes

A Review and Commentary on the Progress in This Branch of Rapid Communication

Conducted by Orrin E. Dunlap, Jr.

Rules for France

A DECREE which has been passed by the French Cabinet, but will not come into force until it has been ratified further, has been drafted by the Minister of Commerce to serve for the future as the statute for the governing of broadcasting in France, and to bring the industry under Government control.

Within five years, according to the decree, all broadcasting stations will be nationalized and will be operated and administered by the State. Programs are to be arranged by a National Board consisting of a member from each of the following organizations: Public Service, National Broadcasting Association, Wireless Trade and Industry, as well as the general public of listeners and critics.

During the next five years licenses to broadcast may be granted by the Ministry of Posts and Telegraphs to existing stations, or to new ones, but with the understanding that they will ultimately be incorporated in the Government system.

The significance of the new ruling lies in the fact that up to the present time no legislation has existed in France to curb the broadcasters.

Radio English

A NEW wrinkle in broadcasting is Great Britain's Advisory Committee on Spoken English, which was formed under the chairmanship of Robert Bridges, the poet laureate. Other members of the committee are George Bernard Shaw, Sir Johnston Forbes-Robertson, Professor Daniel Jones of the London University, and Logan Pearsall-Smith, representing the Society for Pure English. The committee was formed, not to dictate or lay down principles of pronunciation for the country, but to introduce uniformity into the forms of pronunciation used by radio-station announcers.

Seven Stations Located in Mexico City

MEXICO CITY has seven broadcasting stations on the air, and according to reports from radio fans, the waves of CYJ and CZE are spreading the Mexican programs across the United States and into Canada.

The broadcasts consist of talks in English and Spanish and musical selections. Station CYJ is on the air daily, except Sunday, from 10 to 11 P.M., Eastern Standard Time, and CZE broadcasts from 10 to 11 P.M. every day.

CJY has a power output of 2,000 watts, and can be found on the 410-meter wave. The other stations are: CZE, 350 meters; CYA, 300; CYB, 275; CYL, 400; CYH, 375; and CYO, 425.

Cures for "Sick" Broadcast Receivers

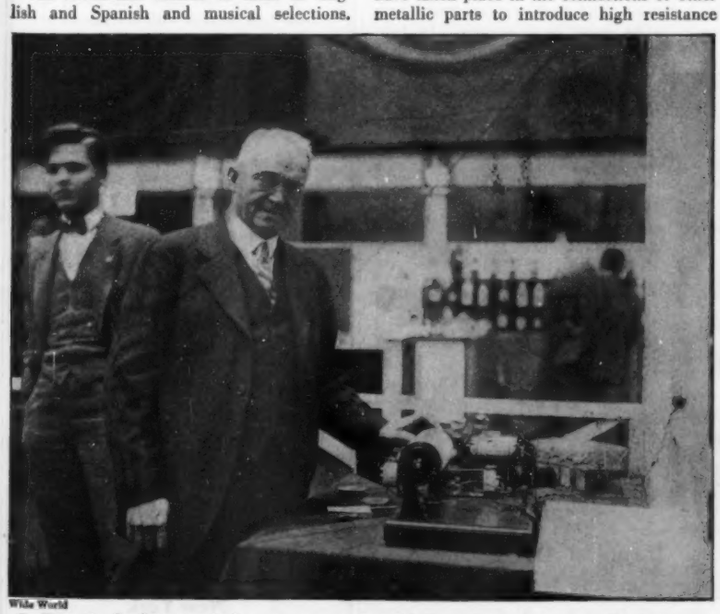
FIRST aid treatment for "sick" radio sets that will enable the man who has only a slight knowledge of radio to recognize the trouble and make the necessary repairs was prescribed by Lee Manley and W. E. Garity at a meeting of the Institute of Radio Engineers. They pointed out that the sets as a rule do not go bad of themselves. The failure usually occurs while some operation is taking place, such as plugging in the loud speaker, turning the condensers or making a change in the battery connections.

If the set has been in operation for a month or six weeks and has been giving satisfactory service for that period, the cause of failure is generally due to the weakening of the batteries.

If the set has been in operation for a period of six months or a year the possibilities of trouble will increase. If the failure has been gradual, the first thought would be that the tubes were worn out.

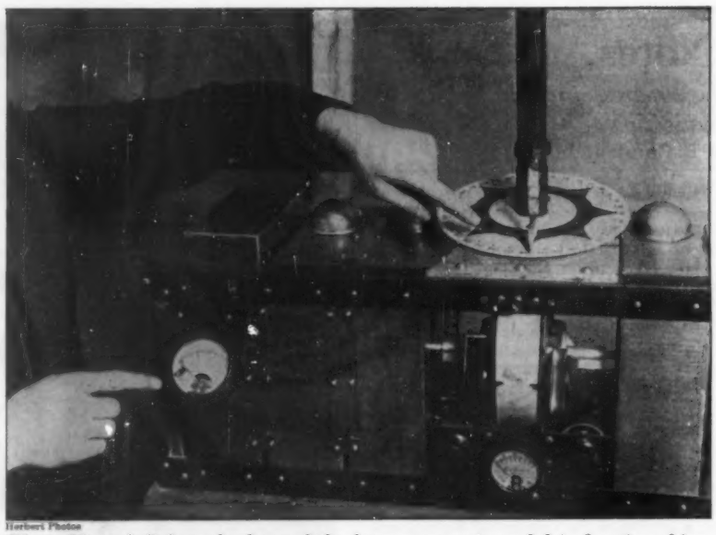
If the break-down is sudden, a mechanical failure might be expected in one of the movable connections, or pigtails, or a transformer may have burned out. If the trouble is due to a noise condition, the failure might be ascribed to dust or dirt accumulations on the condenser plates or other important parts of the receiver. The defect might also be due to a corroded soldered connection. It will require, as a rule, a rather long time for a soldered connection to corrode to such a degree as to cause this condition.

The local atmospheric conditions under which the set has been operating may have some bearing on the cause of failure. If the set has been operating near the seashore and has been subjected to the action of salt atmosphere, sufficient corrosion may have taken place in the connections or other metallic parts to introduce high resistance



Wide World

C. Francis Jenkins and the apparatus that he has developed for radio picture-transmission. These are the instruments used for sending the weather maps described and illustrated on page 411



Herbert Photos

The calibrated dial on the base of the loop antenna is useful in locating ships lost at sea. This dial indicates the direction of the ship transmitting station. The milliammeter registers the signal strength

or leakage paths. Moisture may saturate the cheaper grades of insulating material to such an extent as to cause high-frequency short circuits.

If a set has been operating for a long period of time and has given satisfactory results and then develops noises and scratching sounds, one should not look for a loose connection in the wiring of the set, but rather for an open circuit in the moving parts. Worn mechanical parts are often mistaken for loose connections in the wiring. The wiring is absolutely stationary and it is not likely that it will be disturbed in the ordinary use of the set so as to cause a failure due to a loose connection.

Vernier drive-shafts and vernier plates will wear loose, and while apparently they are making perfect contact to the metal surfaces of the condenser, still when the set is brought into a critical condition, as is the case when receiving distant stations, noises will occur that might be thought due to a loose connection in the wiring.

Studio Spotlight

THE impresario of Station 2LO, London, in an effort to humanize the radio studio and make artists feel as if they were on the concert stage, has introduced a spotlight in the room.

Some temperamental broadcast entertainers complained that they missed the glare of the lights, so the impresario decided to darken the studio and then shoot the rays of a spotlight in the direction of the microphone to give the desired effect.

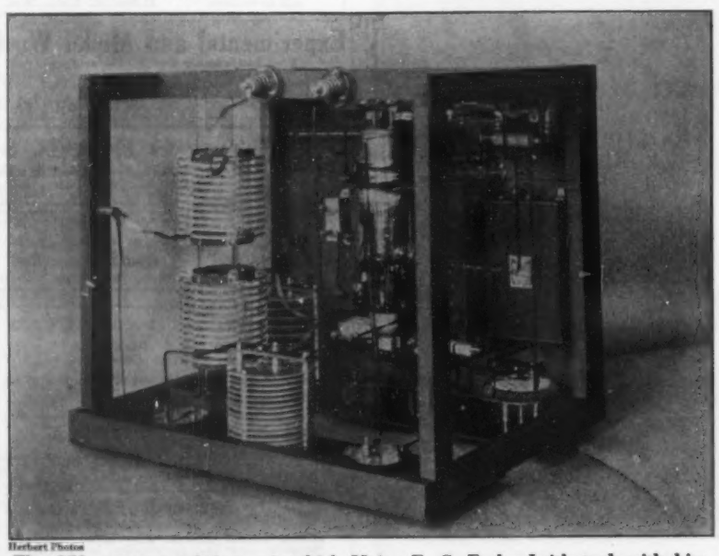
Another scheme to inspire confidence in the artists is to have a skeleton audience laugh and applaud, which helps the broadcaster to feel that he is in personal touch with his auditors.

Fewer draperies are now being used in the studio because the cloth-covered walls "deaden" the voice and in many instances unnerve the entertainer.

One-Way Transmission

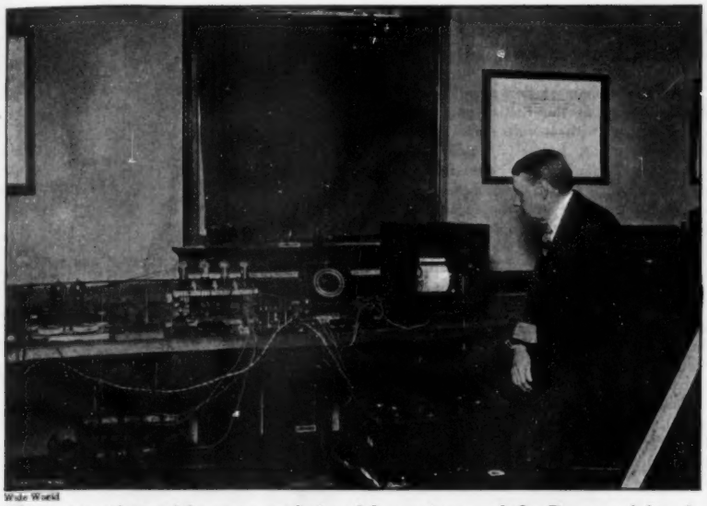
AMATEURS say that at least 80 percent of the cases of good reception on short wavelengths seem to be one-way affairs. For example, when a New York station talks with California, if the former reports the latter's signals as strong, generally the other station reports the signals received as weak, or vice versa. Often it is possible for New York operators to hear Pacific Coast stations clearly without being able to make themselves heard in return.

The phenomena mentioned are almost the rule when working with Brazil, as it is seldom that Brazil reports a strong signal at the same time as New York stations receive good signals from that country. On the other hand, Australia and New Zealand give United States stations consistent reports of nearly the same signal strength day in and day out, and their stations heard here seem to be quite as consistent. In fact, there is less variation in the strength of



Herbert Photos

The 250-watt transmitting unit which Major E. C. Forbes-Leith took with him on an expedition to the interior of Persia. Power for the unit is supplied by a generator driven by the motor-truck's engine



Wide World

This automatic receiving set was designed by engineers of the Bureau of Standards. It is capable of tuning in 12 different wavelengths without the aid of a human operator or any outside control

signals received in New York from New Zealand than there is in signals received from the middle western parts of the United States.

Rugby Most Powerful

A SERIES of tests conducted jointly by the Bureau of Standards and the American section of the International Union of Scientific Radio-Telegraphy to determine the strength of signals from commercial radio-telegraph stations shows that the one at Rugby, England, is the most powerful in the world, according to laboratory records.

The tests were conducted during the months of September and October, 1926, and the stations tested, rated according to their signal strength, are as follows: Rugby, Bordeaux, Ste. Assise, Nauen, Monte Grande, and Rio de Janeiro.

The weakness of the signals from the famous German station at Nauen, of which so much was heard during the World War, was a surprise to the compilers of the report. The French station at Bordeaux, once regarded as unapproachable for the strength of its signals, is revealed as sending far weaker signals than Rugby, which was completed last summer.

Baird Building New Televisor

JOHN L. BAIRD, television inventor of England, has closed his experimental transmitter and is building a much larger station with a four-kilowatt output at Purley in Surrey.

The first work at the new station will be experimental but Mr. Baird is hopeful that actual televisor programs will be presented to the public ere long, according to reports from London. Alterations in the apparatus have overcome the necessity of using two wavelengths and now the pictures can be sent out on one wave.

Receiving outposts are being installed at Dublin, Belfast, Liverpool and Manchester with the object of testing television over long distances. Hitherto the longest distance over which television transmissions have been received is 130 miles.

Glass-air Insulators

GLASS has come into high favor as an insulator at station KDKA where it insulates the heavy copper bands of the transmitter inductance-coil; brass-tipped glass knobs support various condensers on the panel boards, and glass-air insulation has replaced through-the-wall types. The glass-air insulator consists of drilled bell-jars placed on both sides of a circular aperture in the window glass. By bolting the bells together, with the bolt centering in the aperture and the bells separated from the window glass by rubber gaskets, an effectively insulated binding post is obtained.

Foreign Listeners Ask for a Tuning Note

BROADCASTING engineers in Europe are striving to evolve a characteristic tuning note for the various stations, so that listeners can judge the capabilities of their sets by a standard signal.

Herbert Photos

This gun-like contrivance is an aerial system consisting of a wooden pole on which there is a winding of 140 turns of wire tapped at the center. A base is provided for attaching the aerial to a roof

One suggestion made to the British Broadcasting Company is for a pianist at stated times to send out tones of uniform strength.

Several German stations use gongs for this purpose, but the British engineers are experimenting with a more elaborate system involving tuning forks. If adopted, this would entail the use of electrically controlled tuning forks, which would first sound all the notes of the scale simultaneously, and then each note separately up the scale.

12,000,000 Radio Sets

It is estimated that between 12,000,000 and 15,000,000 radio sets are in operation throughout the world. Of these, the United States is believed to have nearly half, or more than 5,500,000 sets.

About 900 broadcasting stations are now operating, more than 500 being in the United States. The actual number of stations which may be operating at any one time is considerably less, owing to the number of divided-time agreements in force; this practice, however, is not common in foreign countries, as the stations are fewer and the distances between them greater. The wavebands used abroad are also much wider.

Argentina Opera in the Ether

The International Standard Electric Corporation has received an order from the Colon Opera House, Buenos Aires, for furnishing and installing a 5-kilowatt broadcasting station similar to WEAF.

The equipment will be of Western Electric design and will embody all the latest improvements. The studio and speech-input equipment will be located in the opera house and the transmitting station on the outskirts of the city. Operatic and other performances, as well as entertainment and educational features, will be broadcast from the new station.

Sound Requires Little Energy

Speech requires a small amount of energy, according to telephone engineers, who explain that if a million persons were to talk steadily and the energy of their voices were to be converted into heat they would have to talk for an hour and a half to produce sufficient heat to make a cup of tea.

One acoustic expert has divided the English speech into 36 letter sounds, and he found that the vowels carry most of the energy. It is estimated that at the upper and lower limits of hearing, it takes 100,000,000 times as much energy to make sound audible as in the range of 1,000 to 5,000 cycles, where the ear is most sensitive.

On the radio, the sounds "th," "f," "s" and "v" are the most difficult to hear correctly. This is attributed chiefly to their very weak energy.

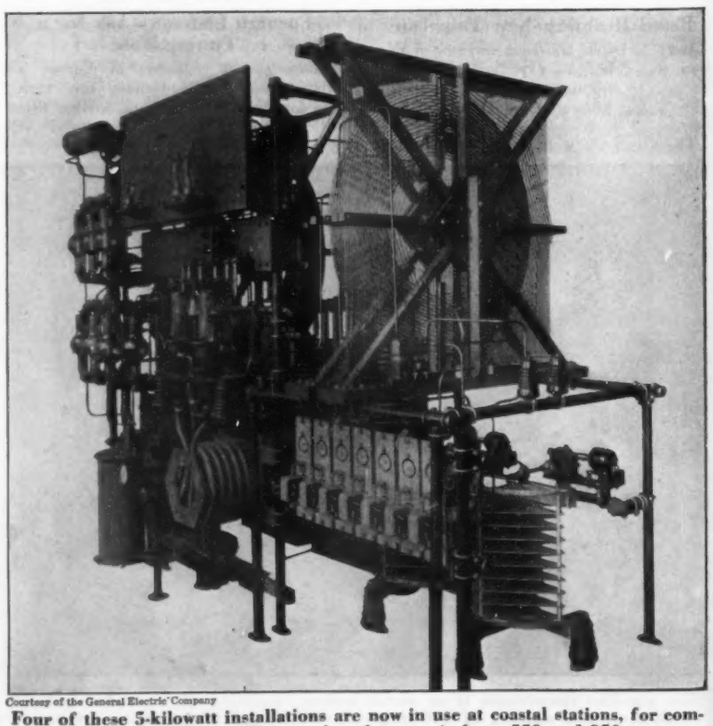
Wide World

Radio transmitting stations located in the mountains of Switzerland, especially in dangerous spots, enable travelers in distress to signal to rescue stations equipped with receiving sets for this particular purpose

Battery Troubles

Overcharging of storage batteries produces excessive gassing and increases the temperature and in general may prove injurious to the batteries, according to George W. Vinal, of the Bureau of Standards.

"Some cases of buckling the plates," said Mr. Vinal, "are to be attributed to over-



Courtesy of the General Electric Company

Four of these 5-kilowatt installations are now in use at coastal stations, for communication with ships. The wavelength range is from 550 to 1,850 meters

charging, although this is by no means the only cause of buckling of the plates. Occasional overcharging is beneficial, but habitual overcharge decreases the period of useful service which the battery can give. On the other hand, consistent undercharging results in a gradual running down of the cells. Likewise insufficient charging is also one of the most common causes of buckling of the plates.

"Corroded terminals on storage batteries are a hindrance to the passage of the normal amount of current and cracked or broken jars invite the addition of water, which weakens the cell capacity. Impurities in the cells may be eliminated by pouring out the electrolyte and flushing the cells with distilled water. Corrosion of the grid, the reversal of the negative and positive plates, the growth of positive plates, the shrinkage of negatives, and explosions are the main sources of battery trouble."

The Heavens in June

By Professor Henry Norris Russell, Ph.D.

At 11 o'clock: June 7.
At 10½ o'clock: June 14.
At 10 o'clock: June 22.

At 9 o'clock: July 7.
At 8½ o'clock: July 14.
At 8 o'clock: July 22.

At 9½ o'clock: June 30.

The hours given are in Standard Time. When local summer time is in effect, they must be made one hour later: 12 o'clock on June 7, etc.

NIGHT SKY: JUNE AND JULY

The Heavens

THE summer constellations are now at their best. Scorpio and Sagittarius are resplendent on the southern horizon, and the great star-clouds in the latter and higher up in Ophiuchus show to their best advantage. Cygnus, Aquila and Lyra adorn the east. Hercules and Corona Borealis are right overhead, and Bootes, Virgo and Leo occupy the western sky. The Great Bear is in the northwest, the Little Bear and the Dragon high in the north, and Cassiopeia low in the north-northeast.

The Planets

Mercury is an evening star all through June, and can be seen best on or about the 22nd, when he is at his greatest elongation, 25 degrees from the sun. At this time he is in Gemini, and sets at 9 P.M. Venus is also an evening star, and so is Mars. The two are in conjunction on the 9th, and only a degree apart. Both are in Cancer, and are far enough from the sun, and far enough north to remain in sight until 10:30 P.M. Venus is far the brighter, outshining Mars by nearly one magnitude, or more than two hundredfold, so that it will take careful looking to detect the farther planet amid the glare of the brighter. As the month wears on, Venus shows to the eastward of Mars, and higher in the sky until, at its end, they are about 8 degrees apart.

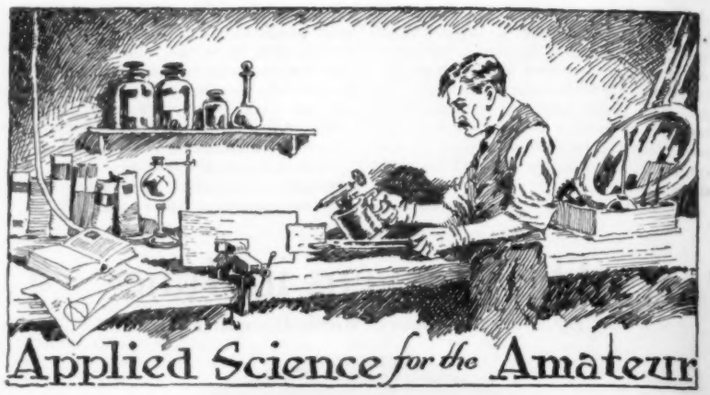
Jupiter is in Pisces and comes into quadrature, west of the sun, on the 24th. He can be observed in the later hours before daybreak. It may be noted in passing that on the 3rd he is close to the vernal equinox —that imaginary point in the heavens from which all longitudes are measured—being, as a matter of fact, little more than 1 degree south of it. Saturn is in Scorpio, and comes to the meridian at 10:30 P.M. in the middle of the month. He is therefore very well placed for observation.

Uranus is in quadrature on the 25th. He is about 1 degree east and rather less than 1 degree north of Jupiter—which will make it quite impossible to see him with the naked eye, for, even if remote from any brighter object, he is near the limit of vision for ordinary eyes. Neptune is an evening star in Leo, rather poorly placed for observation.

The moon is in her first quarter at 3 A.M. on the 7th, full at the same hour on the 15th, during the eclipse, in her last quarter at 5 A.M. on the 22nd, and new at 2 A.M. on the 29th, while the solar eclipse is in progress. She is nearest the earth on the 24th, and farthest off on the 9th.

During her circuit of the skies she passes near Venus on the 3rd (occulting her for observers in the East Indies), near Mars later on the same day, Neptune on the 5th, Saturn on the 13th (with another occultation, visible in western Asia), and finally near Jupiter and Uranus on the 22nd. Curiously enough, there is no conjunction of the moon with Mercury this month. He is moving eastward so fast that she has a "stern chase," and after catching him on May 31st gets her next chance on July 1st.

We may finally note that at 5:22 A.M. on June 22nd the sun reaches his northernmost point, and "summer begins."



A department devoted to the presentation of useful ideas wherein will be found material of practical value for those who are mechanically inclined

Conducted by A. P. Peck

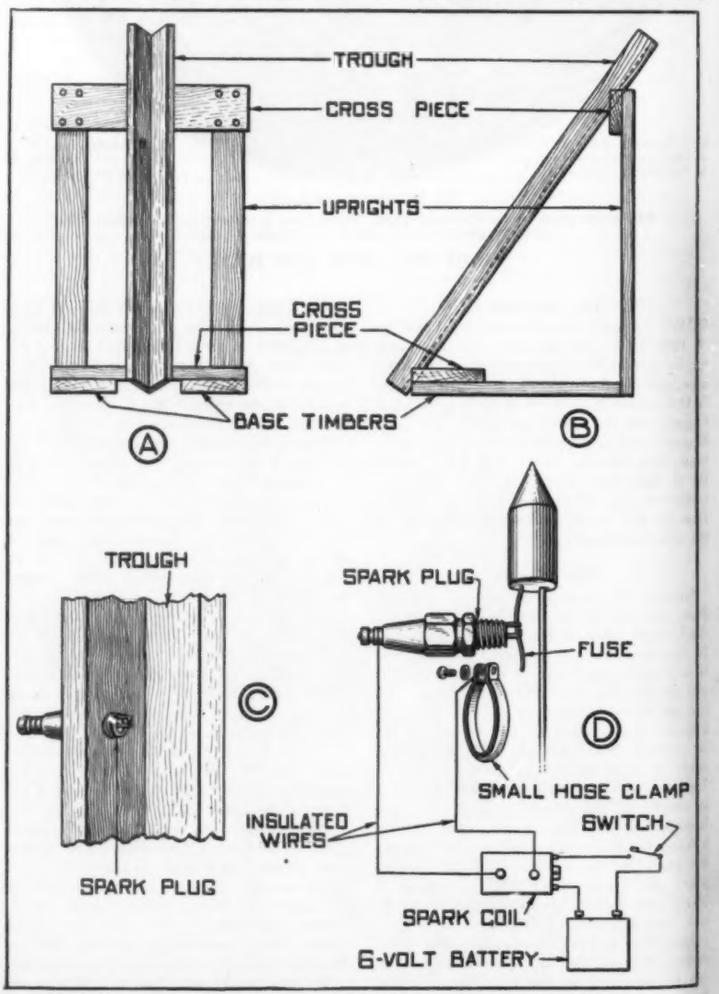
Electric Arrangement for Shooting Sky Rockets

ANYONE who has suffered from the back-flare of a bursting sky rocket will appreciate the safety of firing them off by electricity, using the following method:

Make a frame of heavy plank three feet high and about the proportions and shape indicated. No rules need be followed so long as the frame is heavy and will support a wooden trough at about the angle shown. The top of the trough should project slightly above the top of the frame.

Place a sky rocket in the trough in the position for discharging and mark with pencil the position of the fuse. Then bore a hole through one side of the trough. Into this hole is to be threaded the firing end of a long spark-plug. It should be turned so the firing pins are one above the other. Use two long insulated wires and attach one to the binding post of the plug in the usual manner. The other one is to be fastened to a small metal hose-clamp and the latter fastened tightly around the threads of the plug. These two wires are then connected to the two secondary terminals of a spark coil. The primary terminals are connected to a six-volt battery.

The rocket is placed in position in the trough and the fuse is inserted between the points of the plug. Then, standing at a distance from the rack, press the switch. The spark between the points of the plug



A and *B* show two views of the sky-rocket supporting frame. *C* indicates the position of the spark plug and *D* gives the wiring diagram

will quickly ignite the fuse and in a moment the rocket will roar skywards with absolutely no danger to the operator. This idea is especially valuable where rockets of large size are to be discharged.—*Contributed by L. B. Robbins.*

A Makeshift Depth Gage

HAVING a quantity of holes to drill to a certain depth in wood and not having a depth gage, it was necessary to find a substitute. This was made by cutting a stick the right length to reach from the

A simple depth gage made from two rubber bands and a piece of wood

brace chuck to the top of the work when the drill was inserted to the desired depth. A notch was cut lengthwise of this stick to fit the drill. The stick was then fastened to the drill by two small rubber bands, and the job was done.

A gage of this kind works just as well for bits as for drills by altering the shape a little, and the writer uses one very often. —*Contributed by P. B. Bacheller.*

Loudspeaker Made of Wall-Board

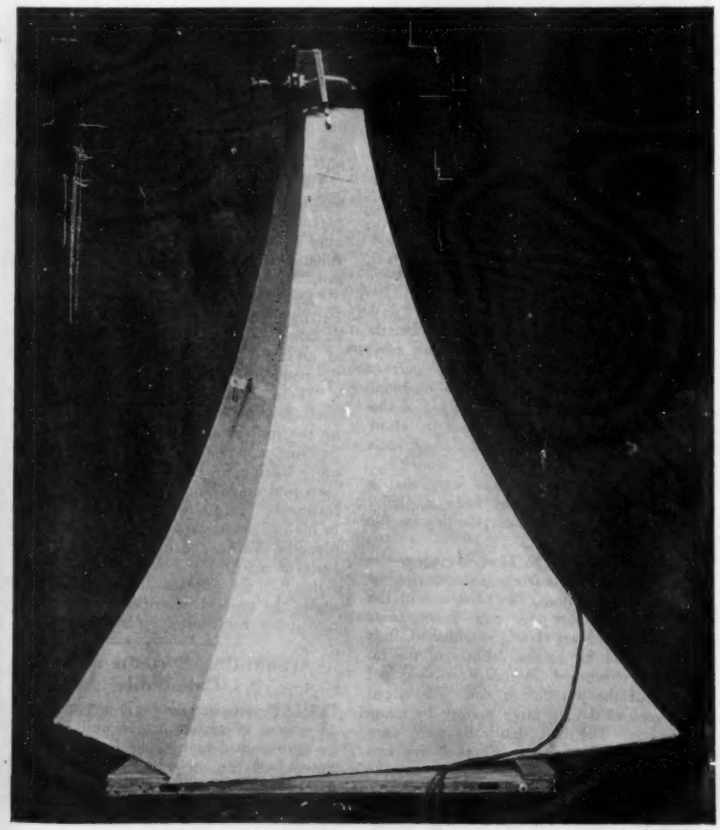
NOT long ago the writer had the misfortune to smash the horn to a fine loudspeaker and, not wishing to spend more money at the time, used the unit in connection with a home-made horn constructed of wall-board. The latter has been in use some time and has proved exceptionally good. The volume is all to be desired and the tones true and absolutely non-metallic, due to the dead quality of the material used. The horn illustrated was cut from spare pieces of board but the pieces can all be taken from a sheet less than 10 feet long.

The width of the stock determined the length of the horn; in this case 32 inches. Two pieces were first cut out with a sharp knife and with the curved sides as can be seen in the photograph. The bases were 24 inches wide and the tips two inches wide. Then two more pieces were cut, of similar shape, but their bases were 23½ inches wide and their tips one and one-half inches wide.

Next, a soft wooden block was fashioned measuring two by one and one-half inches at the small end flaring to a slightly larger size at the other. A hole was bored through the center, and into it was driven the metal ferrule from the old speaker horn. Then the four wall-board sections were tacked around the block. The two sizes allowed the edges to lap over. The four pieces were then carefully brought together down to the wide ends and held in place by winding string about the resulting horn. Then the edges were fastened together with three-quarter-inch brads spaced about two inches apart. This served temporarily but the final step was to strap the corners down with strips of one and one-half-inch paper adhesive tape such as is used for sealing purposes in stores. The 24-inch square opening was then enclosed in a wooden frame and the edges of the wall-board nailed to it.

The speaker unit was attached to the ferrule in the small end by a strap passing over the unit and attaching it to both sides of the horn. A large eye was inserted in the center of one side of the horn by which to suspend the speaker from the ceiling and then the outside and inside were given two coats of suitable paint.

By hanging this speaker from the ceiling in one corner of the room and pointing it slightly down, the volume and tone were found to be splendid, even though the total cost was less than a dollar.—*Contributed by L. B. Robbins.*



The simple loudspeaker made of wall-board as described above

Commercial Property News

A Department of Facts and Notes of Interest to Patentees and Owners of Trademark Rights

Conducted by Milton Wright

A Copyrighted Statue

AT the Boston Museum of Fine Arts stands a famous statue known as "The Appeal to the Great Spirit." Cyrus E. Dallin, the sculptor, obtained a certificate of copyright as a work of art of which copies were not reproduced for sale. This he obtained by depositing in the Library of Congress a single photograph of the statue.

Recently, discovering that John Drescher Company, Inc., and Reinthal and Newman had reproduced pictures of the statue, he sued both of them for infringing his copyright. The Federal Court for the Southern District of New York dismissed his complaints. The reason was a simple one. Where such a registered work of art is later reproduced in copies for sale, the copyright owner must deposit *two* copies.

The Copyright Blues

IF you play a copyrighted song in a public amusement place for profit you are committing an act of infringement and the owner of the song may sue you for damage and an injunction. To S. A. Lewis, manager of the Up-to-Date Dancing School in Minneapolis, the Minnesota District Court handed down a decision awarding Irving Berlin, Incorporated, an injunction and 250 dollars and costs. All Lewis did was have his orchestra play "All Alone."

Animal Head Trademarks

GOODS may belong to the same class and yet not be of the same descriptive properties, Assistant Patent Commissioner Moore holds, in allowing the Edgar-Morgan Company to register as a trademark its mule-head picture accompanied by the words "Old Beck," despite the opposition of Embry E. Anderson whose trademark is a representation of a mule or a horse—the Patent Office is unable to decide which—accompanied by the word "Creamo."

"Anderson's goods, consisting of oats," says the Commissioner, "certainly have not the same descriptive properties as a composition stock food made according to the Edgar-Morgan Company formula and composed of cracked corn, crimped oats, alfalfa meal and molasses, proportioned according to said formula. The fact that the two belong to the same class of goods is no evidence that they have the same descriptive properties. The decision in France Milling Company versus Washburn-Crosby Company is regarded as applicable to the instant case. If 'pancake flour' and 'straight wheat flour' have not the same descriptive properties, it seems clear that oats have not the same descriptive properties as the petitioner's composition stock food."

Potential Confusion Is Enough

THE mere fact that there has been no actual confusion between two trademarks in use will not serve to prevent one of them being refused registration. This is made clear by First Assistant Patent Commissioner Kinnan in denying registration to the Auto Radiator Manufacturing Company's trademark, "Sixcel" arranged in a shape suggesting a six-sided figure. Registration was opposed by the Hexcel Radiator Company, whose trademark is the notation "Hexcel" in a six-sided figure.

"It has been strenuously urged by the applicant company that no confusion of goods has been shown," rules the Assistant Commissioner. "The parties are located about 90 miles apart, but it is alleged on the part of the opposer that the applicant's business has not reached such magnitude as to have brought the latter's use of its mark to the attention of the opposer. There is no satisfactory evidence as to any extensive use by the applicant company of its mark upon its goods. There is some testimony that the opposer company has done a considerably larger business, there being testimony that 20,000 dollars was spent in advertising by the opposer's predecessor in business.

"It is believed under all the circumstances here presented, that the absence of proof of confusion is not conclusive that there is no likelihood of confusion in the future, if the two marks appear upon the same class of goods in the same market. The prefix 'hex' is from the Greek meaning six and, in consequence, the significance of the notations 'Hexcel' and 'Sixcel' is substantially the same.

"It is believed the appearance, spelling and sound of these two words are so nearly alike that confusion of goods or of origin would be inevitable. The opposer company has clearly established use of its mark for a year prior to the date of adoption and use by the applicant of its mark. While it is not believed any doubt exists in the instant case, yet if doubt existed, such doubt should be resolved against the newcomer in accordance with the established rule."

Underwood & Underwood

It is never too late to save. Out in Cicero, Illinois, where banditry is not unknown, the Western State Bank has built a chute in the masonry foundation where deposits may be made at any hour of the day or night. During banking hours, armed guards within are stationed safely behind bullet-proof shields

When Is a Trademark Abandoned?

IF you abandon a trademark, someone else may adopt, use and register it. But what constitutes abandonment? The recent Patent Office interference case, in which First Assistant Commissioner Kinnan held that the United States Whip Company, of Westfield, New Jersey, might register "Black Knight" for fishing lines over the protest of the Shakespeare Company, is illuminating. The Shakespeare Company had used the mark from 1919 to 1923 and then discontinued it, but it asserted that it had not abandoned the mark and expected to use it again.

"It is satisfactorily shown that at one time the applicant adopted and used another mark," the Assistant Commissioner finds, "and, on receiving notice from the opposer of infringement of a similar mark used by the opposer, the applicant company desisted from the use of such mark and requested the opposer, in order to avoid future conflicts, to furnish the applicant company a list of all marks used by the opposer. In response to this latter request, the opposer furnished such a list, as it appeared in their annual catalogue of that date, but did not disclose to the applicant company the mark, the ownership of which is here at issue, nor make any claim to any rights in such a mark. It is believed these circumstances alone establish a doctrine akin to estoppel since it is clear the opposer company should have spoken in response to the request of the applicant company."

Patents Should Be Sought Promptly

THE danger of using an invention without applying for a patent promptly is well illustrated by the recent decision of the Federal District Court in Maryland invalidating the valuable fabric-binding patent owned by Freydberg Brothers, Inc., and upon which they brought an infringement suit against Mark Hamburger.

The patent provided for "a binding material for garments, comprising a length of narrow bias-cut fabric, the length consisting of a plurality of relatively narrow bias-cut pieces joined together on diagonal lines, the opposite longitudinal edges of the fabric being treated with adhesive to retard fraying tendencies of the threads along such edges."

Underwood & Underwood

Inside the Western State Bank a 35-ton vault door has a double alarm system, the usual electric one and a radio sound-wave device whereby any tampering with the vaults is broadcast by means of microphones. The cashier is shown demonstrating how, by merely clapping his hands, the radio device is actuated

The defendant was able to show that a clothing manufacturer had been applying adhesive to rolls of bias-cut binding as far back as 1915.

"Freydberg claims to have hit upon the same expedient as early as the spring of 1921," the court finds, "but the use in the Seinsheimer factory for six years prior thereto having been clearly established, it is immaterial so far as the validity of the invention is concerned whether Freydberg had learned of the practice or not. Fast-edged rolls were used in a large factory by many employees. The fact that rolls were used only in the place where Frankel was employed does not impair the publicity of the use.

"That Freydberg effected a beneficial change in garment making cannot be denied, but clearly his extension or improvement of the Frankel idea was a change rather of degree than of kind. Improvements in a machine or product, which are not of the substance of the patent, and do not add anything to it, will not avoid the invalidating effect of prior use."

Patents and Taxes

PATENT costs, on an income tax return, may be deducted on the installment plan. In other words, the cost to the taxpayer of a patent or a copyright acquired by him may be treated as a deduction by spreading the cost over the life of each patent or copyright. For example, if I acquired a patent to manufacture a non-refillable bottle and paid therefor 10,000 dollars, I could deduct 1,000 dollars a year, if the patent had an unexpired lifetime of ten years.

On the other hand, if I were the inventor of the patent, and had acquired it after expending 1,700 dollars, since the full lifetime of a patent is 17 years, I could write off only 100 dollars per year, because the total cost in cash to me for the patent was 1,700 dollars, regardless of its much greater actual worth.

Peanuts Salted in the Shells

DID you know they salt peanuts without removing the shells? It has been done ever since Frank and Hyman Baker secured a patent for the process in 1910. Furthermore, the patent is said to have been widely infringed, and over one infringer, the Shell-On Sol-Ted Peanut Company, the executors of Hyman Baker have won an important victory in the Maryland District Federal Court.

In carrying out the process, the nuts in their original green state are placed in a suitable container to which the desired quantity of saline solution is added. Pressure is then applied which, in the green condition of the shells, readily forces open the pores of the shells and introduces the saline solution. Then the nuts, while still in the shells, are subjected to the action of heat to evaporate the liquid within the shells, and the nuts are then roasted in the usual manner.

The main contention of the defendants was that the patent was invalid, citing prior patents and old methods such as boiling peanuts in the shell in a saline solution and submerging chestnuts in an unheated solution. The court, however, declared:

"There is nothing in the record in the Patent Office or in the record in this court to show an anticipation of the impregnation of an article of food by pressure through the pores of an enclosing shell.

"There is not only infringement by the Shell-On Sol-Ted Peanut Company, but also by the individual defendant, Huntington D. Sawkins, who is a direct as well as a contributory infringer. He is an executive of the corporate defendant and had a share in its infringing operations. Moreover, he trades in his individual capacity as the Mechanical Machine Works, and under this name manufactured machines to be used by the corporation for the production of salted peanuts under the process described. Such conduct constitutes contributory infringement."

Accounting Systems Are Not Patentable

THAT you cannot obtain a patent for a system of accounting is well illustrated by the recent denial by the Commissioner of Patents of the appeal of Lewis A. Foote from a final rejection of his application for a patent. Says Assistant Commissioner Moore:

"The invention is described as relating to a system of accrual accounting, said system comprising sheets or accounting blanks, and the method of their use.

"The claims for the sheets or blank forms have been allowed.

"The claims on appeal are for the method of using the accounting sheets, or for the steps to be followed in setting up the account thereon.

"The method claims stand rejected by the examiners-in-chief on the ground that they do not define a patentable method; that they do not fall within the definition of an art; and that they are not within the intent or scope of the statute (Sec. 4886, R.S.), relating to patentable inventions, as the statute has been construed by the courts and by the Commissioner of Patents.

"A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing.

"This definition implies a physical subject matter to be acted upon, and a physical force through the agency of which the act or acts are performed.

"It has been repeatedly held by this office and by the courts that methods of transacting business, and like methods, are not patentable as they are neither arts, machines, manufactures nor compositions of matter."

Factories and Good Will

WHERE a factory is sold, there is not necessarily any loss of good will, at least for income-tax purposes. So the Federal Court for the Northern District of Ohio ruled in the suit for a tax refund brought by Acme, Palmers and DeMooy Foundry Company.

The corporation had been organized in 1919 by acquiring two existing corporations, the Acme Foundry Company and the Palmers and DeMooy Foundry Company. The Palmers and DeMooy plant for years was located on what was known as "The Flats" in Cleveland, but this land was condemned for the construction of a terminal building at the Cleveland Public Square and was sold to the Van Sweringens as of January 1, 1920, for 91,600 dollars.

The net taxable profit on this sale was estimated by the Internal Revenue Commissioner as $25,180.61 but the taxpayer contended that the loss of good will sustained by the sale of its property should be allowed and that this would make the total net taxable loss more than 60,000 dollars.

In denying this appeal, the court said:

"There was nothing about the location of the plant in 'The Flats' that made and held its good standing and reputation with the trade. Its standing and advantage with customers old and in prospect had no relation to its location.

"It can be conceived how, with a particular character of business, location might be an element of good will as, for instance, a cigar store on a particular corner, street or building, or, in fact, in the case of most retail businesses whose advantage, standing and reputation were partially created by and dependent upon accessibility to customers and the trading public.

"Whatever good will the Palmers and DeMooy Foundry Company had built up in the years of its operation still largely remained and inured to the benefit of this taxpayer in the retention of the name, 'Palmers and DeMooy Foundry Company.' If any part of good will could be held to have attached to the tangible assets and location of the plant, the loss of it was reflected in the compromise payment for the whole property under the sale of January 1, 1920."

New Uses for Old Principles

MERELY taking an old idea and applying it in a new art is not, ordinarily, sufficient invention to justify a patent, Walter B. Templeton discovered recently when the Court of Appeals of the District of Columbia upheld the Patent Commissioner in his denial of an application on a patent for a construction relating to a socket and a wooden handle for a lifting jack. Said the court:

"The jack is admittedly old in the art, and the process of lifting by an adjustable handle inserted in a socket is old. Appellant discovered that a round wooden handle used for lifting purposes would break when the pressure was imposed across the grain of the wood. Appellant's claims are for a pole shaped so that it can be inserted in the socket in only one of two positions, and when inserted, the direction of the grain is lengthwise of the pole, and thereby gives to the pole or lever its maximum strength.

"To accomplish this result, the socket is made in oval form in cross section, the greater transverse axis being in a vertical plane. The handle thus constructed to fit the socket has its major axis in a vertical plane, and being capable of insertion only in this determined position, the grain of the wood can be so adjusted that when the handle is in position it will be capable of resisting to its maximum strength. But this method of constructing axe handles, hammer handles and tool handles generally, in this strain-resisting shape is old. There is, therefore, nothing patentable in appellant's device."

Patents Recently Issued

Classified Advertising

Advertisements in this section listed under proper classifications, rate 25c per word each insertion; minimum number of words per insertion 24, maximum 60. Payments must accompany each insertion.

Official copies of any patents listed in this section at 15 each; state patent number to insure receipt of desired patent copy.

Pertaining to Aeronautics

AEROPLANE.—The invention provides a supplemental safety wing mounted above the body of the plane and under normal conditions disposed in horizontal position, but so constructed that the plane will automatically glide safely to the ground in case the engine goes dead. The device may be readily applied to old planes. The inventor has been granted two patents, 1617263 and 1617264. L. Marschall, 1710 Woodbine St., Brooklyn, N. Y.

Pertaining to Apparel

CREEPING GARMENT FOR BABIES.—Which can be slipped over the ordinary clothing of a child to protect the clothing and prevent soiling. Patent 1618012. A. F. Jagoe, 170 Christie St., Ridgefield Park, N. J.

BUTTON AND FASTENER THEREFOR.—Particularly adapted for fur garments, including a swingable latch engaging an eye on the button, and means for holding the latch in fastening position. Patent 1619800. H. R. Lichtenstein, 50 W. 29th St., New York, N. Y.

CORSET.—Consisting of a girdle for controlling the figure from the waist down, and a brassiere to fit and control the bust. Patent 1619874. A. Lipman, 2200-04 Lawrence Ave., Chicago, Ill.

UNION SUIT.—A closed seat garment which is comfortable, gives a wide opening along a line extending obliquely down the front of the leg, and is easy to operate. Patent 1621392. J. M. Atkinson, c/o Openheim, Oberndorf & Co., Baltimore, Md.

NECKTIE LINING.—Wherein a reinforcing lining extends from near one end to the other, and most of the lining may be readily exposed for pressing. Patent 1621336. S. Rutenberg, c/o Dr. Shahan, 921 Keogh St., Greensboro, N. C.

Chemical Processes

DIAZO DYE OF DIPHENYL UREA AND CHROMOTROPE ACID.—Which forms in the dry state a blue violet powder soluble in water, a red violet solution in concentrated sulphuric acid, and is especially adapted for fast to light brilliant violet shades. Patent 1617244. R. J. Fletcher, c/o Amalgamated Dyestuff & Chemical Works, 75 Hudson St., New York, N. Y.

Electrical Devices

RADIO EXTENSION CONDUCTOR AND REEL.—Which will permit the extension of the conductor to a distant point where a loudspeaker plug can be connected. Patent 1620562. W. I. Licht, 563 Sheffield Ave., Brooklyn, N. Y.

TERMINAL INSULATOR.—For electric motor terminals, may be easily applied or taken from the terminal and will not be worn to any appreciable extent by vibration. Patent 1620693. H. W. I. Royal, 455 Willis Ave., Youngstown, Ohio.

VOLTAGE REGULATOR.—For regulating the voltage applied to radio sets which are hooked up with a house lighting system, adapted to replace "B" batteries. Patent 1621443. J. B. Trevor, Jr., 11 E. 91st St., New York, N. Y.

Of Interest to Farmers

BEET HARVESTER.—For use in conjunction with a beet topper, having cooperating finger wheels which lift the topped beets from the ground, automatically adjustable to various sized beets. Patent 1620019. E. J. and O. H. Hammer, Miller City, Ohio.

WEEDING MACHINE.—Formed with a plate having a plurality of fingers twisted at an angle to the plate, readily operated either by power or manually. Patent 1620594. A. Christensen and A. W. Warsen, c/o A. Christensen, Box 69, Wilson, Conn.

PLOW.—Having a lift mechanism which may be adjusted for cutting to various depths, especially designed for use with plows employed on tractors. Patent 1620,969. L. C. Hester, Box 255, Jacksonville, Fla.

BEAN AND PEA HARVESTER.—For harvesting beans or peas from vines in the field, and separating the beans or peas from the chaff by a thresher plate and riddle. Patent 1621642. M. B. Sample, R. F. D. No. 5, Elizabeth City, N. C.

PORTABLE LIFTER FOR BEEHIVES.—For lifting filled storage sections of a hive from the lower or brooder section, and for replacing empty sections, without injury to the workmen or bees. Patent 1622201. D. G. Little, Hartley, Iowa.

CULTIVATOR.—Whereby the same beams on opposite sides of a row may be used, in connection with attachments, to cultivate two rows at a time. Patent 1621764. W. P. Allen and E. H. Fincher, c/o Elbert H. Fincher, Goza, Oklahoma.

Of General Interest

EGG SHIPPING BOX.—Characterized by novel means for holding a number of eggs, so that they may be easily packed or removed, and may be shipped without breaking. Patent 1620541. M. O. Ginsburg, 5324 13th Ave., Brooklyn, N. Y.

CONTAINER FOR ICE-CREAM CONES.—From which articles may be dispensed, particularly ice-cream cones in stacks deposited above the vertical axis of the container. Patent 1619883. A. J. Pukt and I. Hendlin, c/o Frank Leveroni, 1015 Tremont Bldg., Boston, Mass.

MONEY TRAY FOR BANKERS AND THE LIKE.—Adapted to hold bills of various denominations, and having means actuated by electricity for instantly conveying the bills to a safe place in case of an attempted robbery. Patent 1619528. A. Mortimer, 457 E. 47th St., Chicago, Ill.

FOLDING TABLE.—In which a pair of boards forming the top, may be rigidly secured to the trestles, and the trestles readily folded in compact form, for storage. Patent 1620061. F. N. Blair, 1323 Maxwell Ave., Spokane, Wash.

MONEY-CHANGER HOLDER.—Which firmly holds the change in a fixed position, obviating the necessity of holding it in place by hand when walking or bending. Patent 1619880. F. F. Neal, 6416 No. Clark St., Chicago, Ill.

CABINET.—Provided with a plurality of shelves interposed between stacks of articles, and means for raising the individual shelves that the different stacks may be accessible. Patent 1619312. Z. P. Pietrzycki, 748 Broad St., Klamath Falls, Oregon.

SIGN.—Adapted for use in various situations, such as stores and on buildings, embodying separate units each having individual illuminating means. Patent 1621412. A. H. Humphrey, Box 54, Salem, N. Y.

DOLL'S LIMB.—Having means for neatly affixing the tubular part of a doll's hand to the arm portion, without wrapping cord or the like about the same. Patent 1621434. I. A. Rommer, 273 Van Sinderen Ave., Brooklyn, N. Y.

SUPPORTING RACK.—For holding books, files, or articles of a limp nature; affording a wide range of adjustment to accommodate articles of various thicknesses. Patent 1621,410. E. W. House, Box 1252, City Hall Station, New York, N. Y.

CONTAINER.—Comprising a case and a drawer slidable into and out of the case, adapted for holding various merchandise, such as cigarettes. Patent 1621451. H. L. Beach, c/o Disbursing Office, Navy Yard, Norfolk, Va.

TOOTHBRUSH.—Which may be manufactured at little cost, placed in a vending machine together with a small amount of tooth paste, and dispensed for a small sum. Patent 1618475. A. P. L. Read, Box 139, Lexington Pike, Covington, Ky.

SASH FRAME.—Which may be conveniently bent from metal stock, and in which a

Argentina's New Trademark Rules

THE provisions of the Argentine Merchandise Identification Act, having caused confusion and misunderstanding among foreign manufacturers, the President, through the Department of Agriculture, has promulgated a new set of regulations in regard to marking goods to show the country of origin. Following are some of its provisions:

The name of a principal city or producing center is now acceptable as showing the country of origin. The abbreviation "U.S.A." is a satisfactory indication of United States origin.

Requirements of the law to show quality, purity, et cetera, are interpreted in a general way. For example; textiles may be marked with the usual trade names such as "canvas" or "cashmere" or by the predominating fibre in the cloth such as "pure wool" or "cotton mixture."

Indications of weight on wrappers or labels must be made in units of the metric system.

The name of the country of origin must be printed on the containers or wrappers or on the objects themselves.

All markings on any one article manufactured of metal must be of the same character, that is, if the trademark is in relief, all other required marks must also be in relief. Machinery is excepted from this requirement and may be marked by means of a mental plate immovably affixed.

Markings required may be in one of the six commercial languages: English, German, French, Italian, Spanish or Portuguese.

Branches of foreign corporations in Argentina, manufacturing the same goods as the home plant, may use the same labels, adding the words "*Industria Argentina*." This provision would indicate that foreign trademarks are not affected by the language restrictions of the Merchandise Identification Act.

It is suggested that American manufacturers contemplating trade with Argentina discuss methods of marking with the United States Bureau of Foreign and Domestic Commerce, furnishing the bureau with labels, prospectuses and catalogs together with a complete description of the product and the materials entering into its composition.

The Art of Noodle Bending

THE Federal Court for the Eastern District of New York, in holding that the patent owned by the C. F. Mueller Company is valid but not infringed by the Clermont Machine Company, discusses in detail the important art of noodle bending. This art,

(Continued on page 436)

in the words of the first of the 30 claims of Mueller's patent, "consists in folding a strip of dough to form a zigzag-shaped body, and permitting said body to remain in said shape until dry."

"The folding mechanism of the Mueller machine," says the court in distinguishing between the two processes involved, "has a horizontally-moving folding blade which strikes the down-hanging noodles at about the center and forces them forward so as to fold them over once, the lower legs resting on a table which moves sidewise in order to form each noodle into a 'V' by moving them aside.

"The first blade then returns and the second folding blade then doubles the noodles and forces them down through the slot, chute or passageway, and they drop in the form of a 'W' onto the conveyor belt.

"In the defendant's machine, the cutting is done by an old Werner and Pfleiderer 'noodle-cutter' at the top of the machine.

"The folding mechanism comprises a feeding belt which travels continuously forward so as to feed the noodle strip forward and onto a strip-laying belt, which moves forward, back, and to the right and left, as desired, so as to cause the noodle which is fed onto it to be laid thereon in the form desired, the resultant form being an inclined 'V.' The belt is then carried forward and at the same time fed forward, at the same rate as its forward movement, causing the 'V'-shaped strip to roll off onto the conveyor belt. The strip-laying belt then moves bodily backward while at the same time continuing to feed forward at the same rate, and this rolls the apex of the 'V' off gently and deposits it, the noodles then being in the staggered form.

"Both Mueller and defendant have the same old elements in the cutting portion of the machine, but no mechanism of the defendant, for the folding of the noodles, can be substituted for that of Mueller although the result of the operation of all of the defendant's mechanisms, working conjointly, is identical with that of Mueller.

"The folding of the noodles must be accomplished either by all of defendant's mechanisms, including the cutting, working conjointly, or all of the Mueller's mechanisms including the cutting, working conjointly, and the doctrine of equivalents does not apply."

Do Not Delay Reissue Applications

THE danger of delaying too long for an application for reissue of an inadequate patent is well illustrated by the recent decision of the Court of Appeals of the District of Columbia upholding the Patent Commissioner's refusal to reissue to Charles Markel a patent with broader claims relating to cross-heads for locomotive engines.

Markel filed his application for a reissue nearly five years after his patent was granted. His delay, he explained, was due to his employment as chief locomotive inspector on new railway locomotives for the United States Railway Administration during the World War. This explanation was rejected on the grounds that he was merely a civil employee of the government for a short time, that he was in the country at all times, and that the nature of his employment did not prevent giving attention to the patent.

"It Shines for All"

CAN you register a representation of the sun as a trademark? That depends upon what class of goods you want to use it with. The California Crushed Fruit Corporation was refused, when it sought to register, for non-alcoholic beverages, a representation of a sunrise with an Indian standing on a bluff. Registration was opposed by Fred W. Wilson, Inc., who uses a picture of a full sun with a laughing face on it, sometimes in connection with the words "Sunkrush Orange."

"While the record fails to show the use of a representation of the sun upon the specific sheet of glass may be rapidly inserted and securely locked. Patent 1621832. H. C. Mills, 3250 W. 126th St., Cleveland, Ohio.

PEN NIB.—Which may be used at substantially any angle, and will contain a large quantity of ink, eliminating constant dipping in the supply. Patent 1621450. H. S. Aramian, 69 W. 100th St., New York, N. Y.

UMBRELLA CASING.—For use in automobiles so that wet umbrellas can be stowed away without damage to the upholstery of the car; the receptacle is removable when desired. Patent 1610026. Emma Miller, c/o William Miller, 90 W. Broadway, New York, N. Y.

IMPLEMENT FOR RESHAPING DISTORTED ELEVATOR BUCKETS.—For instance where the outer walls have become bulged or indented by use; the reshaping being done without detaching the bucket from its support. Patent 1620920.—C. F. Porter, Flat Rock, Ind.

SAW OILER.—Adapted for use by lumber fallers and buckers, the device simultaneously oils both faces of a saw without waste of the lubricant. Patent 1621420. M. Kruse, B.B. Route, Creswell, Oregon.

DISPLAY CONTAINER.—Which enables an attractive display of confections, and at the same time facilitates dispensing the candy, without interfering with the display, or attractive features. Patent 1622194. H. E. Freeman, Crewe, Va.

FLASH-LIGHT HOLDER.—For use by sportsmen, motorists, or workmen working in dark places, conveniently adjustable for throwing a beam of light on a desired area, yet leaving the hands free. Patent 1621645. E. L. Thorp, 1010 Belknap St., Superior, Wis.

CROSS-JOINTED METAL BAR.—For metal window sashes, wherein part of one bar is cut and pressed into a bracing member interlocking with certain parts of the cross bar. Patent 1622235. S. J. Gary, 3242 Decatur Ave., Bronx, N. Y.

PRESSING ARM.—Supported to be swung to a raised position above the ironing board, or used at a lowered position on the board. Patent 1622195. A. Hopkins, c/o Hopkins Mfg. Co., Boston 34, Mass.

TANK VALVE.—For use in cars for transporting oil, employing a wiper ring for action in advance of the valve seating, to insure a perfect joint. Patent 1621638. R. A. McIntyre and A. D. Hastings, 1080 No. Peoria Ave., West Tulsa, Okla.

BEAN STRINGER.—A simple device for manually stringing string beans, the beans being inserted between guide rollers and knives and pulled through. Patent 1621968. J. H. Carter, 336 Center St., Oakland, Cal.

PACKAGE CARRIER.—Having gripping means whereby a small package may be carried by one person or a large package by two persons in tandem. Patent 1622946. C. Haarberg, Box 57, R. F. D., Kent, Wash.

BUILDING CONSTRUCTION.—Which will permit of the erection of buildings by unskilled labor, and with greater rapidity than can be obtained by usual means. Patent 1622997. E. Flagg, 111 E. 40th St., New York, N. Y.

DISH DRAINER.—Whereby the dishes are cleaned and dried without a dish-cloth, reducing the labor also the handling of the dishes. Patent 1622909. M. E. Hatcher, Tyler, Ala.

HAIR-WAVING APPLIANCE AND METHOD.—Which will produce a waved condition of the hair for substantially its full length, in what is known as a permanent manner. Patent 1622957. J. Mayer, c/o A. Kietz, 9710 Euclid Ave., Cleveland, Ohio.

TOBACCO PIPE.—Constructed with means for effecting the absorption and drying up of moisture which ordinarily collects in the bottom of the bowl. Patent 1623009. F. Hoffman, c/o Hoffman Limercier & Co., 444 Notre Dame St., Montreal, Canada.

BOILER STAND.—For domestic boilers, adapted to support boilers of different diameters, also adjustable to support the boiler at any desired elevation. Patent 1622884. O. M. Redlon, 181 Front St., Bath, Maine.

MULTIPLE-RECORD PHONOGRAPH.—Capable of playing more than one record in succession, automatically changing records and repeating successive playing as many times as desired. Patent 1622756. D. D. Beenken, R. F. D. No. 1, Box 321, Santa Barbara, Calif.

SUPPORTING ATTACHMENT FOR CLOTHESLINES.—For connecting and supporting a garment hanger from a clothesline to prevent longitudinal slipping, and eliminate the necessity of tying. Patent 1623919. L. Hagen, 94 Fulton Ave., Jersey City, N. J.

WALL CONSTRUCTION.—In which metal up-rights support reinforcing wire mesh along one edge and metal lath on the other edge for binding concrete and inner walls. Patent 1623917. W. F. Gaudian, 422 No. Alamo St., San Antonio, Texas.

CANDY JUMPING JACK.—Which combines a plurality of wrapper-covered pieces of candy with a carton for holding the same so as to produce a toy. Patent 1623165. W. W. Cassidy, c/o Sweet Candy Co., Salt Lake City, Utah.

AIR-CIRCULATING SYSTEM FOR CARGO VESSELS.—Which introduces a fore and aft inter-deck circulation of air, and permits of the entire width of the ship's use for cargo. Patent 1623922. J. Hudson, 404 61st St., Brooklyn, N. Y.

SHIP.—Provided with a novel type of bumper for cushioning the shock of impact when the ship is swung against a dock, applicable to boats or ships. Patent 1623,888. J. Pasini, 94 Baxter St., New York, N. Y.

Hardware and Tools

EXPANDING TOOL.—Which serves adequately for spreading apart the knuckle ends of the front axle of running gears on automobiles, although not limited to such use. Patent 1621335. A. A. Roesch, Andover, Mass.

TOOL ATTACHMENT FOR HAMMERS.—By which a hammer of the claw type, is converted into a hatchet or chisel without modifying its present construction as a claw hammer. Patent 1620923. L. W. Shaver, 729 "E" St., San Diego, Cal.

CUSHION-SPRING CONNECTION.—For connecting the spring units of a cushion spring to the frame, and insuring a rigid and positive connection. Patent 1622202. V. Massacese, c/o Attilio Verna, 476 9th Ave., New York, N. Y.

COMBINATION SQUARE AND BEVEL.—Which will serve for laying out any desired angle, and will automatically indicate the length of the hypotenuse of any right angle triangle in roofing problems. Patent 1621,192. R. A. Dyke, 629 9th St., Marshfield, Oregon.

TOOL.—Especially designed for threaded parts, to enable a portion of a screw or bolt to be cut off to a desired length without injuring the threads. Patent 1623689. S. A. Lind, 3238 Encinal Ave., Alameda, Calif.

BLOWER FOR SAWS.—Capable of being attached to a saw for removing the sawdust from the lines to be worked to, operable by the workman's thumb. Patent 1623859. C. J. Abbey, 116 Madison Ave., Skowhegan, Maine.

Heating and Lighting

BOILER CONSTRUCTION.—Having novel means for drawing the gases of combustion downwardly after they have passed to the combustion chamber top, thereby utilizing heat normally carried up the chimney. Patent 1621374. W. F. McPhee, 610 E. 91st St., Chicago, Ill.

FIREPLACE CONSTRUCTION.—Whereby the expense of building a heavy masonry construction is eliminated, radiation into the room increased and an ornamental structure provided. Patent 1622944. E. Flagg, 111 E. 40th St., New York, N. Y.

Machines and Mechanical Devices

EXCAVATING MACHINE.—Adapted to dig trenches of various widths and depths, or may be used for digging and elevating potatoes, freed from the dirt. Patent 1619875. T. L. Loftus, 1566 Marion St., Denver, Colo.

VIBRATORY SCREEN.—For screening any material which may be susceptible of grading by screening, such as coal, gravel, sand, grain, etc. Patent 1620575. W. F. Schadel, c/o Kanawha Mfg. Co., Charleston, W. Va.

CHECK-INDORSING ATTACHMENT FOR ADDING MACHINES.—For simultaneously indorsing the checks, and stacking them as they were originally stacked on the support beside the machine, without further effort of the operator. Patent 1620542. R. H. Gladwill and G. M. Ramsey, c/o T. M. Robinson, Robinson & Ogden, Altus, Okla.

PROPELLER GUARD.—For boats, so constructed and mounted as to be readily shifted from an operative to an inoperative position, thus leaving the propeller unhindered.

class here being considered," First Assistant Patent Commissioner Kinnan holds, "yet the the Patton Paint case, as well as the famous use of the notation 'Rising Sun' in connection with a stove polish, furnishes some indication that 'sun' has been so frequently used as to bar opposer from the exclusive use of all representations of it in connection with this class of goods."

Airplane Inventors, Take Notice

A BOARD known as the Patents and Design Board has been created in Washington, consisting of Edward P. Warner, Assistant Secretary of the Navy for Aviation; William P. MacCracken, Assistant Secretary of Commerce for Aviation; and F. Trubee Davison, Assistant Secretary of War for Aviation. The following statement of the board's activity has been made by the Navy Department.

"To this board any individual, firm, or corporation may submit a design for aircraft, aircraft parts, or aeronautical accessories, and whether patented or unpatentable, the said board upon the recommendation of the National Advisory Committee for Aeronautics shall determine whether the use of such designs by the Government is desirable or necessary, and evaluate the designs so submitted and fix the worth to the United States of said design, not to exceed 75,000 dollars.

"The said designer, individual, firm or corporation, may then be offered the sum fixed by the board for the ownership or a nonexclusive right of the United States to the use of the design in aircraft, aircraft parts, or aeronautical accessories and upon the acceptance thereof shall execute complete assignment or nonexclusive license to the United States: provided, that no sum in excess of 75,000 dollars shall be paid for any one design."

New Rules in Austria

TWO new trademark decisions in Austria will interest American exporters. The first requires that if a fanciful designation has become the name of an article, before application to register it as a trademark is made, and if it is regarded in the trade as a statement of quality, it cannot be protected by trademark, even by the originator. For this reason "Insulin" is not protected in Austria.

The second decision is that, when there is a conflict over whether or not two marks resemble each other, the question of resemblance cannot be judged by comparing all the details of each, but by the "picture of remembrance" which the average purchaser preserves from the total remembrance. Mere difference in the main motifs of two trademarks will not avert this sense of confusing similarity.

The Importance of the Patent System

THE *Journal of the Patent Office Society* publishes an address, made by Commissioner Thomas E. Robertson to the National Founders' Association, on "The Patent System—What It Means to Industry." Its peroration is worth reprinting for the burst of oratory it contains.

"It is well to note the difference between the amount of progression in countries which grant many patents and the countries in which inventive genius is at a low ebb. Thus in 1857 the United States granted over 2,000 patents during the year, having at that time 33,000,000. Russia, with a population of about 70,000,000 granted only 24 patents in that same year. Today Russia is a land of darkness and this country the wealthiest on earth. The same comparison may be made with other countries. In fact, as one Commissioner of Patents said many years ago:

"'As the light of liberty waxes dimmer, so does the inventive genius flag and dull apace, until finally, amid the darkness of political night which broods over eastern lands, it is utterly extinguished.'"

Patent 1620129. G. Peterson, Box 63, Tarpon Springs, Fla.

ORE-GRINDING MACHINE.—Of the tube mill type, interiorly enlarged toward its ends permitting the crushed ore to gravitate freely and prevent accumulation of large and uncrushed material. Patent 1620276. G. W. Morthland, 504 Main St., Lead, S. D.

APPARATUS FOR CONTINUOUS EXTRACTION BY PRESSURE.—For separating the juicy matter from the seeds of fruits, consisting of a rotating drum having filtering walls, adapted to press the contents in a variable manner. Patent 1620567. P. Navarre, c/o C. Chassevent, 11 Boulevard de Magenta, Paris, France.

CENTRIFUGAL MACHINE.—As utilized in the sugar industry, having a valve particularly adapted for controlling the flow of mass into the centrifugal. Patent 1620568. C. T. Ordway, c/o Charles Ordway, 363 Linden Ave., Brooklyn, N. Y.

FRUIT-JUICE-EXTRACTING MACHINE.—By means of which all the juice of oranges or lemons may be extracted, and after the extraction the rinds expelled. Patent 1620,551. G. N. Hughes, Box 1298, Atlanta, Ga.

PUMP JACK.—Which eliminates vibration, has advantageous counterbalancing features, is of strong and durable construction, and reliable in operation. Patent 1621414. W. G. and K. R. Jensen, 202 E. Modoc St., Nowata, Okla.

SNOW CLEANER AND DIGGER.—Adapted for shoveling snow, digging earth or other material, and then lifting and discharging the material into a conveyance. Patent 1621448. A. Zilbersher, 800 Lexington Ave., New York, N. Y.

VENDING MACHINE.—Which will maintain a stack of lead pencils and automatically move one at a time to the delivery apparatus upon the depositing of a coin. Patent 1620914. C. E. Parker, 654 Chamber of Commerce Bldg., Los Angeles, Calif.

DOUBLE-ACTION OIL-WELL PUMP.—Especially efficient in the case of deep wells, where the loss of time through the gravity return stroke is very great. Patent 1620,934. A. O. Zinn, 1025 Stock Exchange Bldg., Los Angeles, Calif.

RETTING TANK.—Capable of not only retting fibrous plants, but for dying loose fibers or cloth in small sections, and the manufacture of absorbent material from China grass. Patent 1621658. D. E. DeLape, 12 Los Robbes Ct., Pasadena, Calif.

PNEUMATICALLY-OPERATED LUBRICATOR.—Which can be connected in series, and simultaneously operated at a central point for delivering oil to bearings, and at a stated time. Patent 1621975. J. E. Erskine, 21st and Talleyrand Ave., Jacksonville, Fla.

MACHINE FOR MAKING CIGAR ROLLS.—For cutting out filler roll blanks, separating the filler tobacco, and removing the excess tobacco in making shaped cigars. Patent 1622966. P. Nordenfelt and E. Granstedt, c/o Wawinskys Patentbyrn (H. Albihn), Birger Farlsgatan 16, Stockholm, Sweden.

STEAM TRAP.—Having valve operating mechanism for discharging condensate from a steam line when the condensate within the trap reaches a certain level. Patent 1623,003. A. L. Grand Staff, 28 No. Adolph Ave., Akron, Ohio.

WASHING MACHINE.—In which the operation simulates hand washing, the article being removed from the water then slightly squeezed, such operation being repeated until the article is clean. Patent 1622543. G. W. Rynders, Carpentersville, Ill.

SPEED-CHANGE MECHANISM.—By which speed changes are made by an arrangement of split gears, an indicator warning against manipulating the lever at an inappropriate time. Patent 1623695. W. M. Mitchell, 3 Heath Bldg., Grenada, Miss.

PUMP.—Which includes a plurality of tanks submerged in the water to be elevated, is of durable construction, and smooth and balanced in its operation. Patent 1623,268. J. W. Price and R. M. Leake, Laramie, Wyoming.

AUTOMATIC CLUTCH.—Designed for the main purpose of obtaining a progressive automatic starting of a driven shaft, the operative pressure being given by centrifugal force. Patent 1623862. F. L. Broussouse, c/o Office Picard, 97 Rue St. Lazare, Paris, France.

INSTRUMENT FOR GRAPHIC CONTROL.—A mechanical device for presenting facts accurately and permitting comparisons of magnitude by lines compared to a scale clearly visualized by the human mind. Patent 1623216. E. Szepesi, 320 Broadway, New York, N. Y.

CASING SLIP.—For use in handling drill pipe, wherein a plurality of slips are held in groups to prevent any one slip from falling into the well. Patent 1623885. G. A. Montgomery, Box 2293 Dallas, Texas.

Medical and Surgical Devices

CHEMICAL HEATING PAD.—Having convenient means for pouring in the water, closing the bag so that it cannot leak, and maintaining an even temperature of the chemical mixture. Patent 1620581. M. A. Smith, 8 Hurlbut St., Albany, N. Y.

SURGICAL INSTRUMENT.—For curetting or otherwise treating internal and external cavities, and eliminating the flushing method, for the removal of dead tissue, by substituting a suction method. Patent 1621212. M. C. Myers, 464 California St., San Francisco, Calif.

DENTAL RELATOR.—Whereby the frame connection and movement will simulate the movement of the jaws of the person for whom the set of teeth is being made. Patent 1622910. J. Homer, P. O. Box 239, Times Square, New York, N. Y.

Musical Devices

MUSICAL INSTRUMENT.—Wherein a single vibratile or sounding member is provided with means for changing the pitch as the instrument is operated for playing tunes. Patent 1618908. W. Bartholomae, 7913 Bay Parkway, Brooklyn, N. Y.

BAR FOR GUITARS.—For Hawaiian guitars, whereby the bar or steel freely rotates without presenting obstructions likely to catch the strings. Patent 1618884. F. C. Meyer, 586 Quincy St., Brooklyn, N. Y.

MUSICAL INSTRUMENT.—Where a single string is used and yet by a proper manipulation, different tones secured in any desired order. Patent 1622219. W. Bartholomae, 7913 Bay Parkway, Brooklyn, N. Y.

Prime Movers and Their Accessories

COOLING MEANS FOR INTERNAL-COMBUSTION ENGINES.—By which air may be drawn through the space between the ordinary water jacket and the cylinder walls, in this manner cooling the engine. Patent 1618614. P. Walters, Mohican Park, Dobbs Ferry, N. Y.

INTERNAL-COMBUSTION ENGINE.—Provided with valve control between the combustion and expansion chambers, so that compression explosion and feeding into the expansion chamber always occur in timed relation to one another. Patent 1618692. W. M. Tompkins, Los Banos, Calif.

EXPLOSIVE CHAMBER FOR GAS ENGINES.—In which a gaseous fuel is fired under pressure and exhausted from the chamber to generate power for use in connection with impact turbines. Patent 1620565. J. B. McKeown, 16 Knox Ave., Grantwood, N. J.

AIR HEATER AND MOISTENER FOR CARBURETORS.—For preventing the usual refrigeration, maintaining the proper temperature of the firing chamber, preventing preignition and decreasing carbon deposits in the cylinders of a motor. Patent 1623438. W. J. Priestley, South Sioux City, Neb.

Railways and Their Accessories

CROSSING SIGNAL.—Which is durable in use, can be located on any rail anywhere, is entirely mechanical, and is automatically operated by the passage of a train. Patent 1620600. J. B. Gebhard and H. Althaus, c/o J. B. Gebhard, Dyersville, Iowa.

VALVE GEAR.—Adapted to locomotives of standard construction, providing quick admission of fluids at the beginning, and quick release at the end of the piston stroke. Patent 1622464. M. J. O'Leary, Chickasha, Okla.

Safety Devices

SAFETY BLOW-OFF COCK.—An attachment which can be used on any standard type of valve casing to prevent the valve being knocked out or accidentally removed. Patent 1611674. A. M. Popkin, 1714 52nd St., Brooklyn, N. Y.

Pertaining to Recreation

BOXING APPARATUS.—A "dummy" punching device normally in upright position, and after having been struck a blow will automatically quickly swing back to upright position. Patent 1620598. E. E. Foster, Box 763, Montgomery, Ala.

GAME.—Comprising a table having a plurality of pockets at one end and a track within which a ball may be propelled to the pockets. Patent 1622156. J. N. Kornahrens, Summerville, S. C.

AMUSEMENT DEVICE.—Wherein tiltable figures are presented capable of being knocked down by a ball, extreme skill being required to knock down more than one at a time. Patent 1622981. F. W. Tanaka, 9 W. 98th St., New York, N. Y.

Pertaining to Vehicles

AUTOMOBILE SIGNAL.—Including a frame, a pointer electromagnetically controlled to oscillate within the frame, and an electric lamp for illuminating the pointer. Patent 1618907. W. L. Baldwin, c/o American Telephone & Telegraph Co., 925 3rd Ave., Troy, N. Y.

MOTOR-VEHICLE CONTROL PEDAL.—Whereby the accelerator may be controlled by the brake pedal without the operator removing his foot, thereby making it possible to instantly apply the brake. Patent 1619421. H. E. Hull, Wardman Park Inn, Washington, D. C.

RADIATOR FILLER.—An ornamental device, representing a bell but which may be inverted and engage over an opening in the radiator cap to prevent spilling the water. Patent 1619498. W. F. Combs and J. M. Beck, c/o J. E. Duhl, Attorney, Mammoth, Utah.

HEADLIGHT.—Having a reflector which will project the light downwardly and forwardly, and in which a dull finished surface adjacent the bulb will prevent glare. Patent 1619617. W. B. Johnson, 227 Roades Ave., Lexington, Ky.

DUST CAP.—For automobile tire valves, so constructed that it may be quickly applied to or removed from the stem without screwing or unscrewing. Patent 1619710. W. F. Duryea, 336 Union St., Hackensack, N. J.

TIRE TOOL.—For engaging a socket of a locking ring, so that it may be forced beneath the ring to lift it out of locking position. Patent 1619426. A. F. Lew, Baker, Oregon.

TRAP DEVICE FOR SEPARATING WATER FROM PETROL.—Formed by inserting in the petrol supply pipe a tube containing baffle plates, connected with a sump from which water and impurities may be drawn. Patent 1619713. N. A. Frean, c/o Collison & Co., 483 Collins St., Melbourne, Australia.

TRANSMISSION BAND.—A brake band adapted for Ford automobiles, having lugs for supporting the clamping bolt and means for maintaining the bolt against rotation. Patent 1619983. J. Malligan, Central Garage, Point Marion, Pa.

TRANSMISSION.—With novel means for connecting the shafts for the two highest speeds, and for disconnecting all intermediate gears while the highest speeds are used. Patent 1620004. A. B. Bowman, 1118 Garland St., Flint, Mich.

PENDULUM INCLINATION INDICATOR.—For use in connection with vehicles to indicate the percent of a grade when ascending or descending a hill, also useable as a spirit level. Patent 1619317. H. J. Smith, Camp No. 5, Big Creek, Calif.

VULCANIZER.—For the vulcanization of tyre tubes for motor cars, the repairing elements being heated automatically during the required time for ensuring vulcanization. Patent 1620597. P. F. M. A. Fontana, c/o C. Chassevent, 11 Boulevard de Magenta, Paris, France.

FLEXIBLE COUPLING.—Which is sufficiently elastic to allow for a limited disturbance in alinement of the shafts, without effecting the transmission of power. Patent 1620592. W. F. Briscoe, 651 Schiller Ave., Trenton, N. J.

LICENSE-PLATE UNIT.—Mounted on a casing and the perforated characters adapted to be illuminated, of such character that it cannot be removed without mutilation. Patent 1621411. A. H. Humphrey, Box 54, Salem, N. Y.

HUMIDIFYING DEVICE.—An attachment for automobile engines, wherein the cylinders may be maintained clean by a continuous but slight injection of steam vapor. Patent 1621430. J. Phillips, 1 Manhattan Ave., New York, N. Y.

PNEUMATIC-TIRE ARMOR.—Which affords facilities for protecting the tread of a pneumatic tire without appreciably lessening the resiliency, and is quickly and easily applied or removed. Patent 1622161. J. C. Mire, R. F. D. No. 2, Baton Rouge, La.

DIRECTION SIGNAL FOR MOTOR VEHICLES.—Readily applicable to closed or open cars, and manually operable to indicate various signaling positions. Patent 1620379. C. B. Mitchell, 5019½ Moneta Ave., Los Angeles, Calif.

AUTOMOBILE SANDER.—Adapted to be associated with the vehicle and manually controlled by the operator to discharge sand immediately in the path of the driving wheels. Patent 1622165. E. P. Robinson, 1440 Broadway, New York, N. Y.

HUB-CAP.—Which is designed to prevent injury to the odometer by engaging with the curb and also to prevent tampering with the device. Patent 1621556. J. J. Matnick and J. L. Silverstine, c/o J. L. Silverstine, 4922 Broadway, Chicago, Ill.

TRANSMISSION CASE.—So constructed that the speed bands and brake band may be readily removed and replaced, or adjusted to take up wear, particularly adapted for Ford automobiles. Patent 1622978. V. E. Shakespeare, 202 Livermore Ave., West New Brighton, S. I., N. Y.

DIFFERENTIAL LOCK FOR MOTOR VEHICLES.—Adapted to lock together the spindles driven through a differential so that the same will rotate in unison and represent one continuous and rigid spindle. Patent 1622449. F. J. Katz, Box 12, Shreveport, La.

END CONNECTION AND SHOCK ABSORBER FOR VEHICLE SPRINGS.—For use in substitution for the ordinary spring shackle used upon automobiles and motor trucks, the device is simple, durable and readily applied. Patent 1623651. H. T. Ayres, c/o The Graden Mercantile Co., Box 984, Durango, Colorado.

Designs

DESIGN FOR A BEDROOM SLIPPER.—Patent 71969. L. Goldberg, c/o Vincent Horwitz Co., 33 Greene St., New York, N. Y.

DESIGN FOR A CURTAIN-POLE END.—The inventor has been granted two patents on ornamental designs for curtain-pole ends. Patents 72004 and 72005. A. Dlouhy, c/o H. L. Judd Co., Wallingford, Conn.

DESIGN FOR A PEDESTAL OR SIMILAR ARTICLE.—Patent 72071. E. T. Palmenberg, c/o J. R. Palmenberg, 63 W. 36th St., New York, N. Y.

DESIGN FOR A GLOVE OR THE LIKE.—Patent 72069. W. E. Meyers, c/o Louis Meyers & Son, 110 5th Ave., New York, N. Y.

DESIGN FOR A HANDKERCHIEF.—Patent 72065. Elaine Journet, 328 W. 101st St., New York, N. Y.

DESIGN FOR A COMBINED ASH TRAY AND PIPE HOLDER.—Patent 72062. E. G. Forbes, 1440 Broadway, New York, N. Y.

DESIGN FOR A PRINTED FABRIC OR SIMILAR ARTICLE.—Patent 72076. H. R. Terhune, c/o Skehan & Sweeny, 113 Worth St., New York, N. Y.

DESIGN FOR A TEXTILE FABRIC OR THE LIKE.—Patent 72192. H. Silberman, 440 4th Ave., New York, N. Y.

DESIGN FOR A SIGNAL LIGHT FOR AUTOMOBILES.—Patent 72185. O. E. Uhlmann, c/o Keller Brass Co., Grand Rapids, Mich.

DESIGN FOR A DRESS.—Patent 72244. Maude Siegel, c/o Franklin Simon & Co., 38th St. and 5th Ave., New York, N. Y.

DESIGN FOR A LAMP.—Patent 72214. J. Lieberman, 39 W. 22nd St., Bayonne, N. J.

DESIGN FOR A KITCHEN RANGE.—Patent 72202. W. Bennett, c/o Graff Furnace Co., 116 Wooster St., New York, N. Y.

DESIGN FOR A CURTAIN-POLE END.—Patent 72251. A. Dlouhy, c/o H. L. Judd Co., Wallingford, Conn.

DESIGN FOR A POLE END.—Patent 72258. W. F. Hofmann, c/o H. L. Judd Co., Wallingford, Conn.

DESIGN FOR A DRESS.—Patent 72300. T. Davis, c/o Franklin Simon Co., 38th St. and 5th Ave., New York, N. Y.

DESIGN FOR A COAT.—Patent 72335. M. Siegel, c/o Franklin Simon Co., 38th St. and 5th Ave., New York, N. Y.

DESIGN FOR A BATHING SUIT.—Patent 72310. T. Davis, c/o Franklin Simon Co., 38th St. and 5th Ave., New York, N. Y.

DESIGN FOR A HAND BAG.—Patent 72326. H. Margolin, 1237 Broadway, New York, N. Y.

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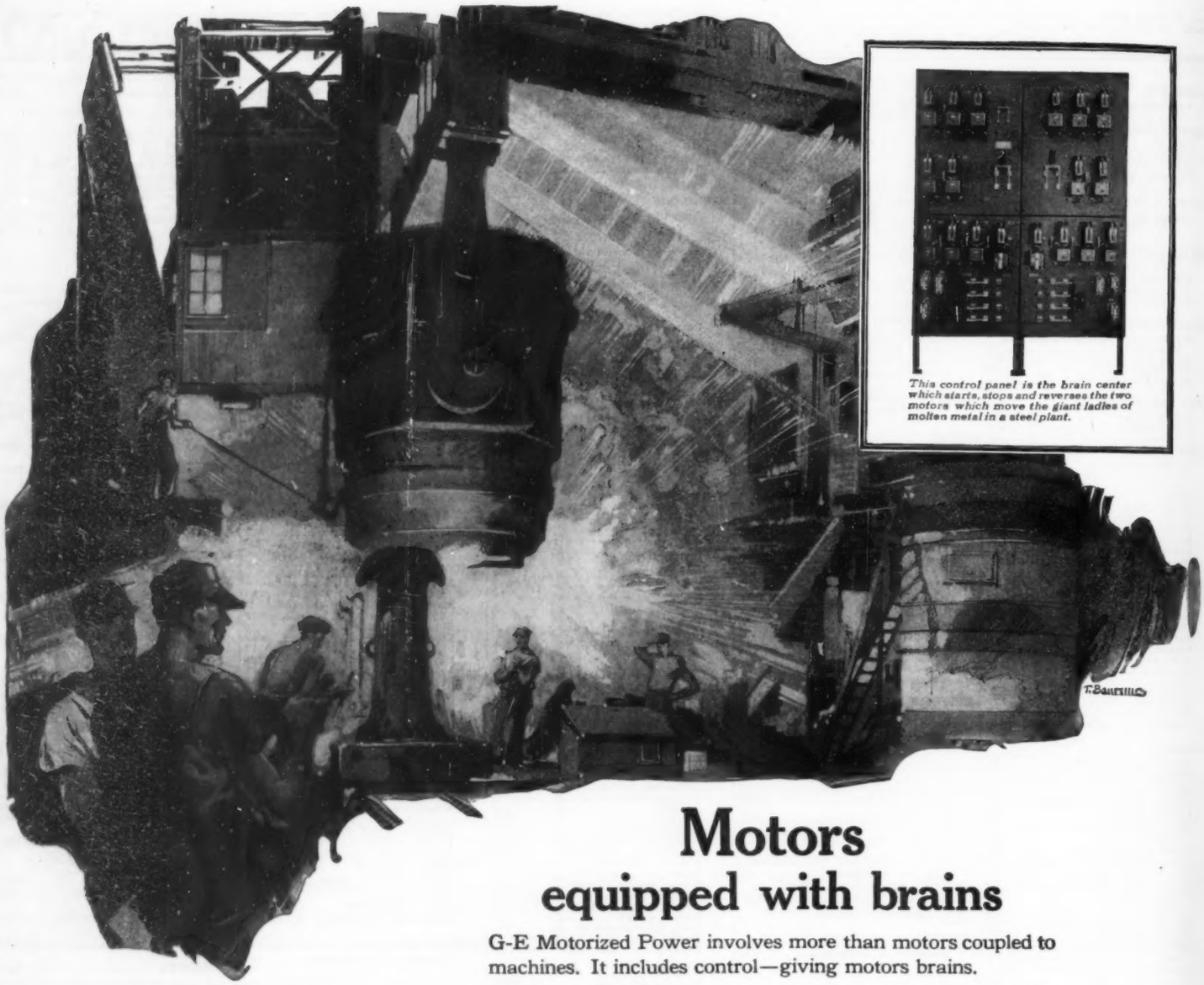
Lack of space makes it impossible to give many cross-references or to enter a given reference in more than one place. Each article is therefore entered where it is believed it will be most easily found. In every case, the general subject should be sought rather than the supposed specific title of an article. We call special attention to the classifications "Aviation," "Radio," etc., under which many items will be found whose location otherwise would be very puzzling. The asterisk (*) indicates that the article in question is illustrated.



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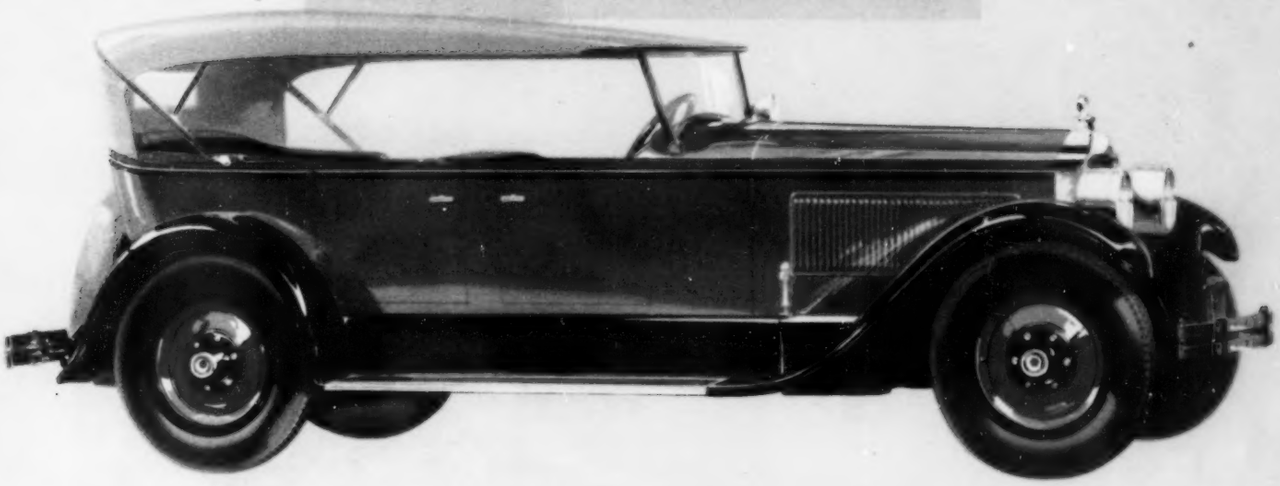

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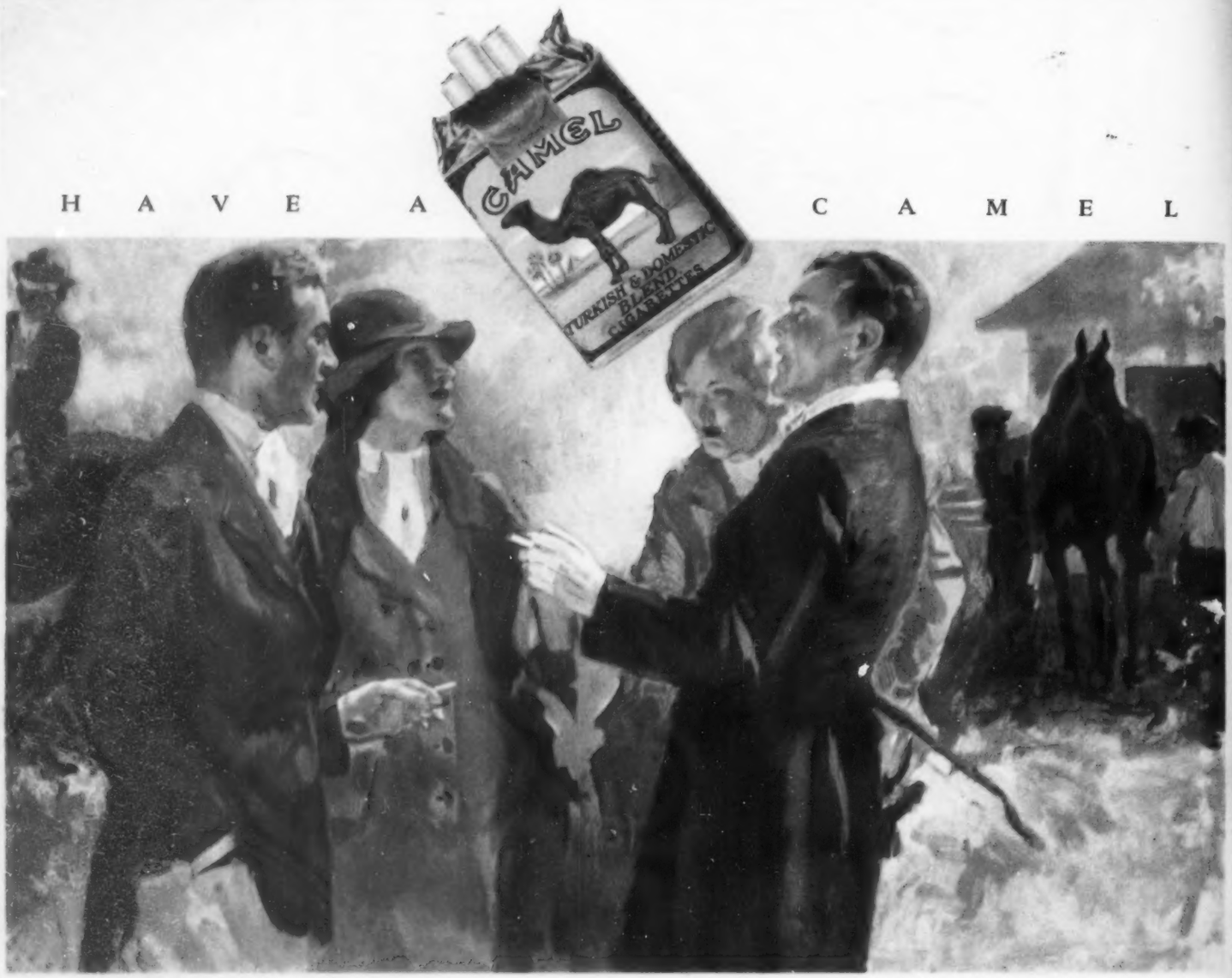

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